PB-230 523

POLLUTION OF THE INTERSTATE WATERS OF THE ESCAMBIA RIVER BASIN (ALAMBA-FLORIDA) AND THE INTRASTATE PORTIONS OF THE ESCAMBIA BASIN WITHIN THE STATE OF FLORIDA. PROCEEDINGS OF CONFERENCE HELD AT GULF BREEZE, FLORIDA ON JANUARY 21-22, 1970. VOLUME 1

Federal Water Pollution Control Administration
Washington, D. C.

1970

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CONFERENCE IN THE MATTER OF POLLUTION OF THE INTERSTATE WATERS OF THE ESCAMBIA RIVER BASIN (ALABAMA-FLORIDA) AND THE INTRASTATE PORTIONS OF THE ESCAMBIA BASIN WITHIN THE STATE OF FLORIDA - VOLUME I

Holiday Inn-South
Gulf Breeze, Florida
January 21-22, 1970

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Conference in the Matter of Pollution of the Interstate Waters of the Escambia River Basin (Alabama-Florida) and the Intrastate Portions of the Escambia Basin within the State of Florida, held at the Holiday Inn-South, Gulf Breeze, Florida, on January 20, 1970, at 9:30 a.m.

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PROCEEDINGS

OPENING STATEMENT

BY

MURRAY STEIN

MR. STEIN: The conference is open.

This conference in the matter of pollution of the interstate waters of the Escambia River Basin (Alabama-Florida) and the intrastate portions of the Escambia Basin within the State of Florida, is being held under the provisions of section 10 of the Federal Water Pollution Control Act.

At this point, I would like to call on Mr. Nathaniel Reed of Florida who has a message from the Governor of Florida.

Mr. Reed.

MR. REED: Thank you, Mr. Stein.

I would like to read this short statement which was telephoned to me from the Governor this morning.

"Chairman Reed:

"I wish to welcome the participants of the Federal-State conference to Pensacola. The Escambia River and Bay are a rich natural resource which is important to the marine fisheries of the Gulf States. The rapid decline of Escambia Bay's fisheries as a productive nursery affects many lives and businesses.

"Industry has traditionally been made welcome in Florida. The State's strategic location, a fine climate, and our greatest resource, a willing, able and skilled labor force, combine to make Florida a premier industrial site. Industry has the responsibility of maintaining the environment which makes our State attractive. The problems of the Escambia River and Bay are not unsolvable. There is a fallacious notion held by some people that industrialization precludes a productive bay. That is Nineteenth Century thinking. It is not a question of one or the other. On this small earth, already crowded by man, we must find ways of living with ourselves and nature. The question is not industry or the bay, but how to encourage industry and preserve the bay.

"By joining forces -- government, industry and our citizens -- we can build a new record; a record of awareness, a record of responsibility. It will cost money. The results can be worth the expense.

"I have called this conference to achieve prompt action. I care about results. If reasonable men work together difficult problems can be solved. Remember: Man has been on the moon.

"Please bring me a personal report as to the spirit and results of this conference. Claude R. Kirk, Jr. Governor of Florida."

MR. STEIN: Thank you, Mr. Reed.

Under the provisions of the Federal Water Pollution Control Act, the Secretary of the Interior is authorized to call a conference of this type when requested to do so by the Governor of a State. In a letter dated December 1, 1969, to the Honorable Walter J. Hickel, Secretary of the Interior, Governor Claude R. Kirk of Florida requested that a conference be called to consider pollution of the interstate waters of the Escambia River Basin and the intrastate portions of those waters within the State of Florida. On the basis of this request, Secretary Hickel, on December 11, 1969, sent a notice of conference to the official State water pollution control agencies. These agencies are the Alabama Water Improvement Commission and the Florida Department of Air and Water Pollution Control.

Both the State and Federal Governments have responsibilities in dealing with water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control pollution. Consistent with this, we are charged by law to encourage the States in these activities.

At the same time, the Secretary of the Interior is charged by law with specific responsibilities in the field of water pollution control in connection with pollution of interstate and navigable waters. The Federal Water Pollution Control Act provides that pollution of interstate or navigable waters which endangers the health or welfare of any persons shall be subject to abatement. This applies whether the matter causing or contributing to the pollution is discharged directly into such waters or reaches such waters after discharge into a tributary.

The purpose of the conference is to bring together the State water pollution control agencies, representatives of the U. S. Department of the Interior, and other interested parties to review the existing situation, and the progress which has been made, to lay a basis for future action by all parties concerned, and to give the States, localities, and industries an opportunity to take any indicated remedial action under State and local law.

The Alabama Water Improvement Commission will be represented by Dr. Ira Myers and Mr. Arthur N. Beck; and the Florida Department of Air and Water Pollution Control will be represented by Mr. Nathaniel Reed and Mr. Vincent Patton.

The Federal conferee is Mr. John Thoman, Regional Director of our Southeast Region, with headquarters in Atlanta.

My name is Murray Stein. I am from headquarters of the Department of the Interior in Washington, D.C., and the representative of Secretary Hickel.

The parties to this conference are the official State water pollution control agencies and the U. S. Department of the Interior. Participation in this conference will be open to representatives and invitees of these agencies and such persons as inform me that they wish to present statements. However, only the representatives of the State water pollution control agencies and the U. S. Department of the Interior constitute the conferees.

Now a word about the procedures governing the conduct of the conference. The conferees will be called upon to make statements. The conferees, in addition, may call upon participants whom they have invited to the conference to make statements. In addition, we shall call on other interested individuals who wish to present statements. At the conclusion of each statement, the conferees will be given an opportunity to comment or ask questions, and I may ask a question or two. This procedure has proven effective in the past in reaching equitable solutions.

Now, let's go over and understand that procedure again. We will not entertain questions or comments from the floor, because if we do we will probably overstay your glorious hospitality. We would like to move ahead in an expeditious manner. However, you can be assured that everyone will have an opportunity to be heard fully. So save your questions and comments and you will be given an opportunity to make those points when your turn comes to speak.

At the end of all the statements, we shall have a discussion among the conferees and try to arrive at a basis of agreement on the facts of the situation. Then we shall attempt to summarize the conference giving the conferees, of course, the right to amend or modify the summary.

Under the Federal law, the Secretary of the Interior is required at the conclusion of the conference to prepare a summary of it which will be sent to the conferees.

Opening Statement - Murray Stein

The summary, according to law, must include the following points:

1. Occurrence of pollution of interstate or navigable waters subject to abatement under the Federal Act;

2. Adequacy of measures taken toward abatement of pollution; and

3. Nature of delays, if any, being encountered in abating the pollution.

The Secretary is also required to make recommendations for remedial action if such recommendations are indicated.

A record and verbatim transcript of the conference is being made by Mrs. Marilyn Hall. This is being made for the purpose of aiding us in preparing a summary, and also for providing a complete record of what is said here. It usually takes about three or four months for the transcript to come out in printed form. If you wish a record beforehand, you can check with the reporter, Mrs. Hall, who is an independent contractor, and make your own arrangements with her.

I should like to point out here that we do not print the transcript in color, so take into account that any charts you may present will be done in black and white.

Opening Statement - Murray Stein

Try not to refer to color in your statements if you wish to use graphic aids in your presentation as they tend to be meaningless in the reading of the transcript.

We shall make copies of the summary and transcript available to the official State water pollution control agencies. We have generally found that for the purpose of maintaining relationships within the States the people who wish summaries and transcripts should request them through their State agency rather than come directly to the Federal Government. The reason for this is that, when the conference has been concluded, we would prefer people who are interested in the problem to follow the normal relations in dealing with the State agencies rather than the Federal Government. This has worked successfully in the past and we will be most happy to make this material available for distribution.

I would suggest that all speakers and participants other than the conferees making statements come to the lectern and identify themselves for purposes of the record.

For the agenda, we will call on the Federal representatives first; then on the State of Florida; and then on the State of Alabama.

Mr. Thoman, may I call on you for the Federal presentation?

STATEMENT OF JOHN THOMAN, REGIONAL
DIRECTOR, SOUTHEAST REGION, FEDERAL
WATER POLLUTION CONTROL ADMINISTRATION,
ATLANTA, GEORGIA

MR. THOMAN: I would like first to incorporate our report as a part of the record.

MR. STEIN: Without objection, this will be placed in the record as if read.

(The document above referred to follows.)

EFFECTS OF POLLUTION ON WATER QUALITY

ESCAMBIA RIVER AND BAY, FLORIDA

January 1970

U. S. Department of the Interior
Federal Water Pollution Control Administration
Southeast Water Laboratory
Technical Services Program
Athens, Georgia

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I. INTRODUCTION

In August 1969, the Southeast Region of the Federal Water Pollution Control Administration received a request for technical assistance in evaluating interstate and intrastate pollution from waste sources entering the Conecuh-Escambia River downstream of Brewton, Alabama, and Escambia Bay near Pensacola, Florida. This request was transmitted from the Governor of Florida through the Florida Department of Air and Water Pollution Control. An investigation of waste sources in Florida and Alabama and a detailed study of the receiving waters were conducted during the period of September 8-25, 1969 and October 22-30, 1969. This report presents an evaluation of the data collected during these studies.

The cooperation and contributions of various State, local and private organizations are gratefully appreciated. Particular acknowledgements are due to personnel and students of the University of West Florida and to the Bureau of Sanitary Engineering of the Florida Department of Health and Rehabilitative Services as well as the Florida Department of Air and Water Pollution Control and the Alabama Water Improvement Commission.

II. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The area considered in this report is the Conecuh-Escambia River in Alabama and Florida downstream from Brewton, Alabama, and Escambia Bay as well as Mulat-Mulatto Bayou in Florida.

The entire upper section of Escambia Bay north of the L & N railroad bridge is in a state of accelerated eutrophication as shown by unstable dissolved oxygen variations resulting from algal activity; high carbon, nitrogen and phosphorus concentrations; and oxygen demanding sludge deposits. Dissolved oxygen at the bottom of nearly half of the bay was less than the 4.0 mg/l criterion established by the State of Florida for these waters. The closely spaced piling under the L & N bridge adversely inhibits circulation, flushing and exchange between the upper and lower bay. In Mulat-Mulatto Bayou, dredging and filling for interstate highway construction and residential development, in addition to the above conditions, also contribute to degraded water quality. These conditions are the major causes of the numerous fish kills reported in Escambia Bay and Mulat-Mulatto Bayou during 1969.

The lower section of the bay south of the L & N bridge also has degraded water quality, primarily due to sludge deposits. The only factor preventing an identical condition as that of upper

Escambia Bay is the flushing and exchange of pollution out of the area in a relatively short period of time.

These water quality conditions in Escambia Bay and Mulat-Mulatto Bayou are caused by the discharge of carbonaceous, nitrogenous and phosphorus wastes from the following sources in Florida; Escambia Chemical Company, American Cyanamid Company, Monsanto Company, the City of Pensacola Northeast sewage treatment plant; and the Container Corporation of America in Brewton, Alabama. The total amount of pollution discharged from these five sources is more than 136,000 population equivalents of carbonaceous wastes; 651,000 population equivalents of nitrogenous wastes; and 135,000 population equivalents of phosphorus wastes.

The major dischargers of carbonaceous wastes are the Monsanto Company, Container Corporation and American Cyanamid. Escambia Chemical Company, American Cyanamid and Monsanto Company are the principal contributors of nitrogenous waste to Escambia Bay. The Pensacola Northeast sewage treatment plant also discharges significant amounts of nitrogenous material. Monsanto Company and Escambia Chemical discharge most of the phosphorus, although the Northeast sewage treatment plant is also a significant source.

Container Corporation of America and the City of Pensacola Northeast sewage treatment plant reportedly provide about 80% removal of their carbonaceous waste at the present time. Furthermore, approximately four fifths of the residual carbonaceous waste from Container Corporation is stabilized in the Escambia River before reaching Escambia Bay. American Cyanamid has a primary treatment facility. It is estimated that American Cyanamid removes about 37% of its carbonaceous waste. Both Escambia Chemical and Monsanto provide no treatment to the waste effluents evaluated in this report.

American Cyanamid Company also discharges acrylonitrile. This compound is toxic to fish. Although it has not been directly demonstrated, the wastes from American Cyanamid could be directly responsible for some of the fish kills occurring in the north and northeast sections of Escambia Bay.

The heat discharged in the cooling water effluents from the Monsanto Company and Gulf Power Company is such that the temperature of the Escambia River is increased above the recommendations of the National Technical Advisory Committee to the Secretary of the Interior which specify a maximum increase of 4°F from September through May and 1.5°F from June through August. Monsanto's cooling water increased the surface temperature of the Escambia River by 19.5°F immediately downstream from the outfall. Three-hundred yards downstream from the Monsanto outfall, surface water temperatures were 7°F greater than background. The Gulf Power effluent increased the surface river temperature by 12.25°F.

Benthic fauna in the Escambia River at the Alabama-Florida State line near Century, Florida, showed no significant damage from waste sources above the State line during the October 1969 field investigations. However, during extended periods of extreme low flow in the Escambia River near Century, Florida, (1966 and 1968), wastes from upstream sources in Alabama degraded the habitat to a level sufficient to appreciably affect the diversity of the biota at the Alabama-Florida State line. Dissolved oxygen levels at the Alabama-Florida State line were above 4.0 mg/l at all times during 1969.

Color in the Escambia River was increased from 70 units to about 120 units from Brewton, Alabama, to Century, Florida. This color increase results from the discharge of treated industrial waste from Container Corporation of America. The official water quality criteria of the States of Florida and Alabama require that no color producing substances causing deleterious effects be discharged to receiving waters.

Waste discharges to the Escambia River and Escambia Bay in the States of Alabama and Florida cause pollution which endangers the health or welfare of persons in Florida and, therefore, are subject to abatement under the provisions of Section 10 of the Federal Water Pollution Control Act as amended (33 USC 466 et seq.).

B. RECOMMENDATIONS

To reduce or eliminate the accelerated eutrophication of Escambia Bay and Mulat-Mulatto Bayou, and to provide water quality suitable for a wide diversity of desirable uses, the following water quality management and waste abatement program is recommended:

1) Minimum reductions amounting to 94% carbonaceous, 94% nitrogenous, and 90% phosphorus wastes respectively discharged to Escambia River and Bay from all sources. All waste sources provide complete removal of settleable solids. The allowable waste discharges from each of the major sources listed are as follows:

SOURCE	CARBONACEOUS		NITROGENOUS			PHOSPHORUS	
	5-Day BOD	TOC	TKN	NH_3-N	NO_2NO_3-N	Total	Ortho
American Cyanamid	425	500	249	32	42	-	-
Container Corp.	2230*	3120*	30	12	-	17	8
Escambia Chemical	17	12	197	137	143	35	35
Monsanto	605	282	102	66	80	46	29
Northeast STP	137	39	101	84	-	23	12
TOTAL	3414	3953	679	331	265	121	84

BOD = biochemical oxygen demand

TOC = total organic nitrogen

TKN = total Kjeldahl nitrogen

NH_3-N = ammonia nitrogen

NO_2, NO_3-N = nitrite-nitrate nitrogen

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*The contribution to Escambia Bay from this effluent will be 450 pounds per day of five-day BOD and 625 pounds per day of TOC.

The recommended alternative for accomplishing these objectives is the construction of a sewer collection system around the entire bay to intercept wastes from American Cyanamid, Escambia Chemical, Monsanto and Northeast sewage treatment plant as well as future and minor present effluents. This is consistent with the concept of metropolitan planning for waste management. All domestic and industrial wastes to be treated at a central facility with discharge away from Escambia Bay after the recommended carbon, nitrogen and phosphorus reductions have been accomplished.

2) Color in the Escambia River at the Alabama-Florida State line as measured at the Highway 4 bridge near Century, Florida, reduced to background levels measured above the Container Corporation of America discharge.

3) No further construction dredging permitted in Escambia Bay or Mulat-Mulatto Bayou until a plan for development of the shoreline has been established. At that time, construction dredging permitted only in accordance with this plan, to be completed within one year by representatives of Escambia and Santa Rosa Counties, the City of Pensacola, the State of Florida, the U. S. Army Corps of Engineers and the U. S. Department of the Interior. Any necessary maintenance dredging in the interim conducted by diking the dredging area. Maintenance of existing channels by hydraulic pipeline dredging only. Disposal of all dredged material to upland spoil sites.

4) The L & N railroad bridge across Escambia Bay to be rebuilt, by not later than January 1, 1973, to eliminate the piling presently adversely affecting the circulation and exchange of water in the bay.

5) The American Cyanamid Company immediately reduce acrylonitrile concentrations in its waste effluent below 10% of the levels demonstrated to be toxic to fish.

6) The Monsanto Company and Gulf Power Company, by not later than January 1, 1973, abate the excessive heat being discharged in their respective cooling water effluents.

7) Century, Florida, install secondary waste abatement facilities and provide effective disinfection of wastes at all times.

C. WASTE ABATEMENT SCHEDULE

Two alternatives are presented to comply with the waste abatement recommendations: a central facility which will accept wastes from all sources in the Escambia Bay area for carbonaceous, nitrogenous and phosphate removals; or individual waste reduction, amounting to at least 90% removal of carbonaceous material for each waste source, in addition to a central tertiary treatment facility designed for further carbonaceous reductions as well as nitrogen and phosphorus removal. Waste abatement facilities removing 90% carbonaceous material must be completed and in operation by January 1, 1973 in order to comply with the implementation schedule set by the State of Florida. Alabama's implementation schedule specifies February 15, 1973 as the final date for completion and operation of waste abatement facilities.

III. AREA

Escambia Bay

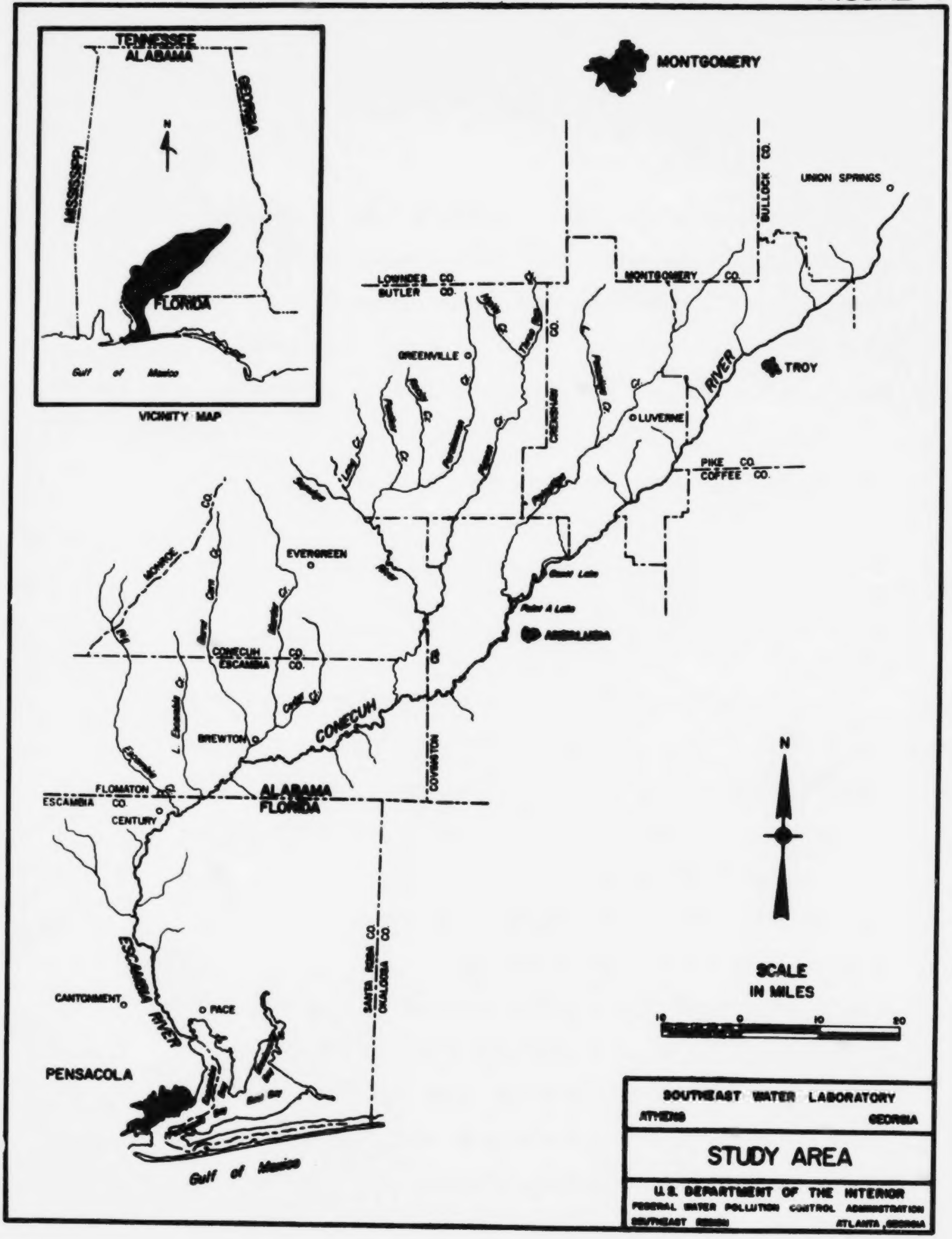
Escambia Bay is one of the northeast branches of Pensacola Bay. It is a shallow estuary with depths ranging from three to about 15 feet. A north-south ship channel, maintained at a depth of 10 feet at mean low water, allows barge traffic to navigate into the Escambia River. The study area is shown in Figure 1.

Pensacola, the largest city in the area, lies along the northern shore of Pensacola Bay. The population of the metropolitan area is 224,000 (1965)(1). The mean annual temperature at Pensacola is 68.4°F and the average annual rainfall is 62.9 inches. Mean wind velocities vary from 8.5 to 6.1 miles per hour for the months of January and July, respectively.

Fresh water enters Escambia Bay from the Escambia River which has the fifth largest average flow in Florida(2). The river drainage basin includes 3800 square miles of southeast Alabama and northwest Florida. The major portion of the drainage basin lies in Alabama and is characterized by hilly terrain with many perennial streams. The flat swampy river delta has dense vegetation which causes the river to meander with sluggish velocity.

Ground water, which is plentiful and of good quality, is the primary source for municipal and industrial supplies. A sand and gravel aquifer lies 200 to 1000 feet below land surface and yields large quantities of soft, unmineralized water. Below the sand and gravel aquifer lies the Floridian limestone aquifer, which is virtually

FIGURE 1


TENNESSEE
ALABAMA
GEORGIA
MISSISSIPPI
N
FLORIDA
Gulf of Mexico
VICINITY MAP
MONTGOMERY
BULLOCK CO.
UNION SPRINGS
LOWNDES CO.
BUTLER CO.
MONTGOMERY CO.
GREENVILLE
CRENSHAW CO.
TROY
LUVERNE
RIVER
PIKE CO.
COFFEE CO.
Long Cr.
EVERGREEN
MONROE CO.
Gantt Lake
Point A Lake
ANDALUSIA
CONECUH CO.
ESCAMBIA CO.
BREWTON
CONECUH
COVINGTON CO.
L. Escambia Cr.
Escambia Cr.
FLOMATON
ALABAMA
FLORIDA
ESCAMBIA CO.
CENTURY
ESCAMBIA RIVER
CANTONMENT
PACE
PENSACOLA
SANTA ROSA CO.
OKALOOSA CO.
East Bay
Gulf of Mexico
N
SCALE
IN MILES
10
0
10
20

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

STUDY AREA

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

untouched in this area. The sand and gravel aquifer is recharged by rainfall within the drainage basin and provides base flows in the surface streams during drought conditions.

During the Escambia Bay field investigations, air temperatures at Pensacola averaged from 75 to 78°F with a maximum of 85°F on the 25th of September and a minimum of 67°F on the 24th of September. These average temperatures are slightly below the monthly mean for September which is 78.2°F. Fog and smoke or haze were reported for this period as well as sky cover ranging from 80 to 100%.

No rainfall occurred at Pensacola during the sampling of Escambia Bay, although several days earlier a tropical depression from the Gulf caused heavy rains to the north and east of the area. Pensacola reported a total of 0.59 inches from this storm while three to four inches were reported across the headwaters of the Escambia River. Although normal rainfall for September is 7.69 inches, only 3.09 inches were recorded for September 1969, a deficiency of 4.60 inches for the month.

Winds were generally absent at night and calm to moderate during daylight hours. Velocities at Pensacola ranged from 3.8 to 5.9 mph with maximum velocity measured at 13 mph on the 23rd of September.

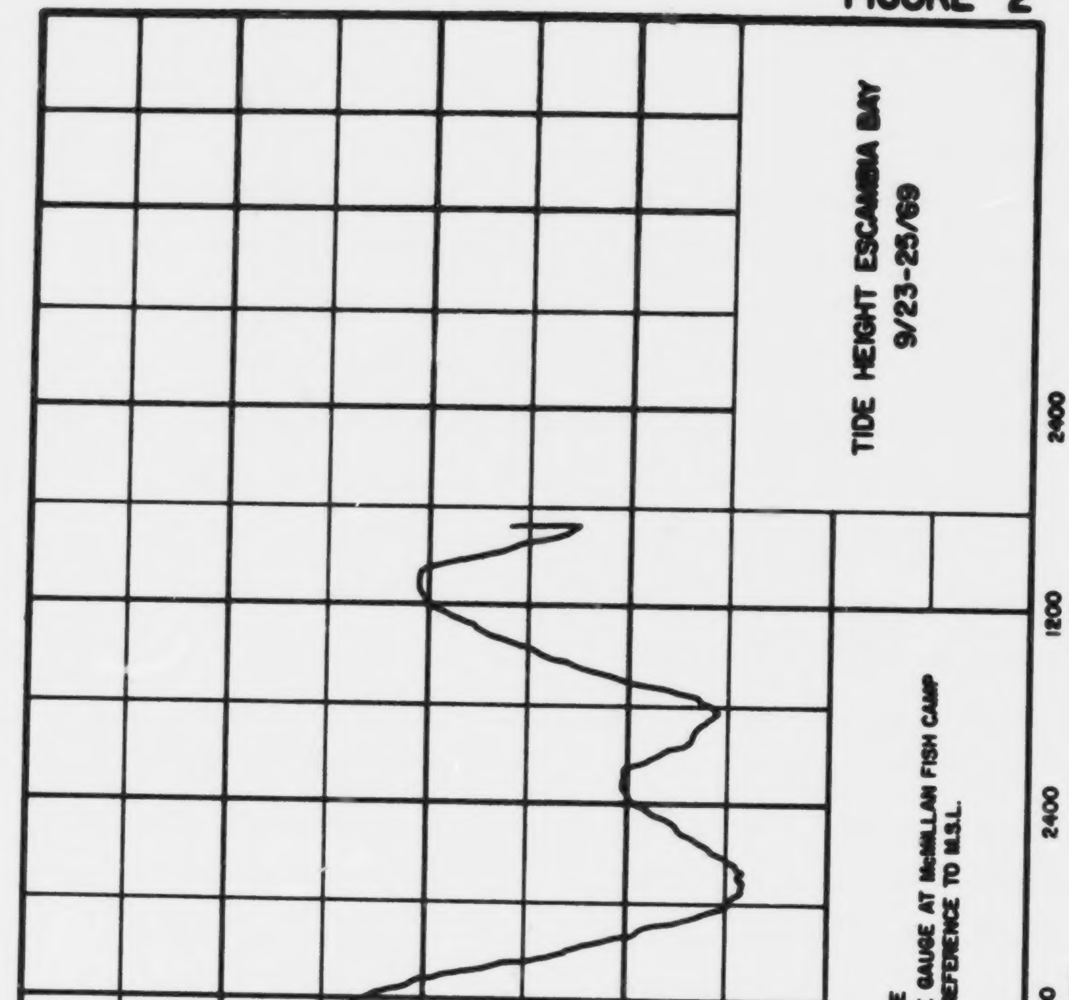
Flows on the Escambia River near Century during the Escambia Bay field study were recorded as follows:

Date	Av. Daily Flow (cfs)
9/17	932
18	914
19	914
20	1030
21	1260
22	3960
23	9130
24	11,600
25	11,500

The high flows were a result of the heavy rains of September 19th and 20th in the upper part of the basin. Since time of water travel from Century to the headwaters of the bay is estimated at about four days, the higher flows reported at the Century gage did not affect the waters of Escambia Bay during the sampling period. Low flows were about usual for this time of the year.

Tide gages were established during the field operations at Smith's Fish Camp on the Escambia River and at McMillan's Fish Camp on Mulatto Bayou. The data from these gages were used in conjunction with data from the official tide gage at Pensacola. Figure 2 shows the tidal variation during the study period at McMillan's Fish Camp. Spring tides occur at a frequency of twice a year at Pensacola. Inspection of Figure 2 shows that spring tide occurred on September 23rd cresting at about 11:00 am at one foot higher than other high tides measured during the study period. During the 24-hour period between 6:00 pm on the 24th and 6:00 pm on the 25th of September, two complete tidal cycles were experienced rather than the normal diurnal tide cycle of one per 26 hours. Escambia Bay has a greater tidal range than Pensacola Bay, shown by comparison of predicted tide height in Pensacola with those measured in upper Escambia Bay.

FIGURE 2


TIDE HEIGHT ESCAMBIA BAY
9/23-25/69
NOTE
TIDE GAUGE AT McMILLAN FISH CAMP
NO REFERENCE TO M.S.L.
FEET
0
1
2
3
4
5
TIME
1200
9/23/69
2400
1200
9/24/69
2400
1200
9/25/69
2400

Escambia River

The Escambia River is formed by the junction of the Conecuh River and Escambia Creek just north of the Alabama-Florida state line. The Conecuh River, larger of the two tributaries, rises in Bullock County, Alabama, and flows southwest through Pike, Crenshaw, Covington and Escambia Counties, Alabama. The main stem of the Escambia River, south of the Alabama-Florida state line, forms the boundary line between Santa Rosa and Escambia Counties, Florida, and flowing almost directly south terminates in Escambia Bay east of Pensacola, Florida (Figure 3).

The drainage basin of the Escambia River contains 3817 square miles and based on a 30-year period of record near Century, Florida, has an average annual flow of 6100 cubic feet per second (cfs) and a maximum and minimum flow of 77,200 cfs and 596 cfs, respectively. Based on a period of record from 1935 to 1965, the seven-day minimum flow with a recurrence interval of ten years is 785 cfs.

During the past 12 years (1957-1968), the yearly mean flow at Century has varied from a high of 8435 cfs in 1960 to a low of 2,889 in 1958 (Figure 4). Record low flows occurred in 1968 including a seven-day low flow of 614 cfs occurring in September.

The average daily flows occurring during the period of the Escambia River study were as follows:

October 20, 1969 - 1620 cfs
October 21, 1969 - No data
October 22, 1969 - 1770 cfs

FIGURE 3

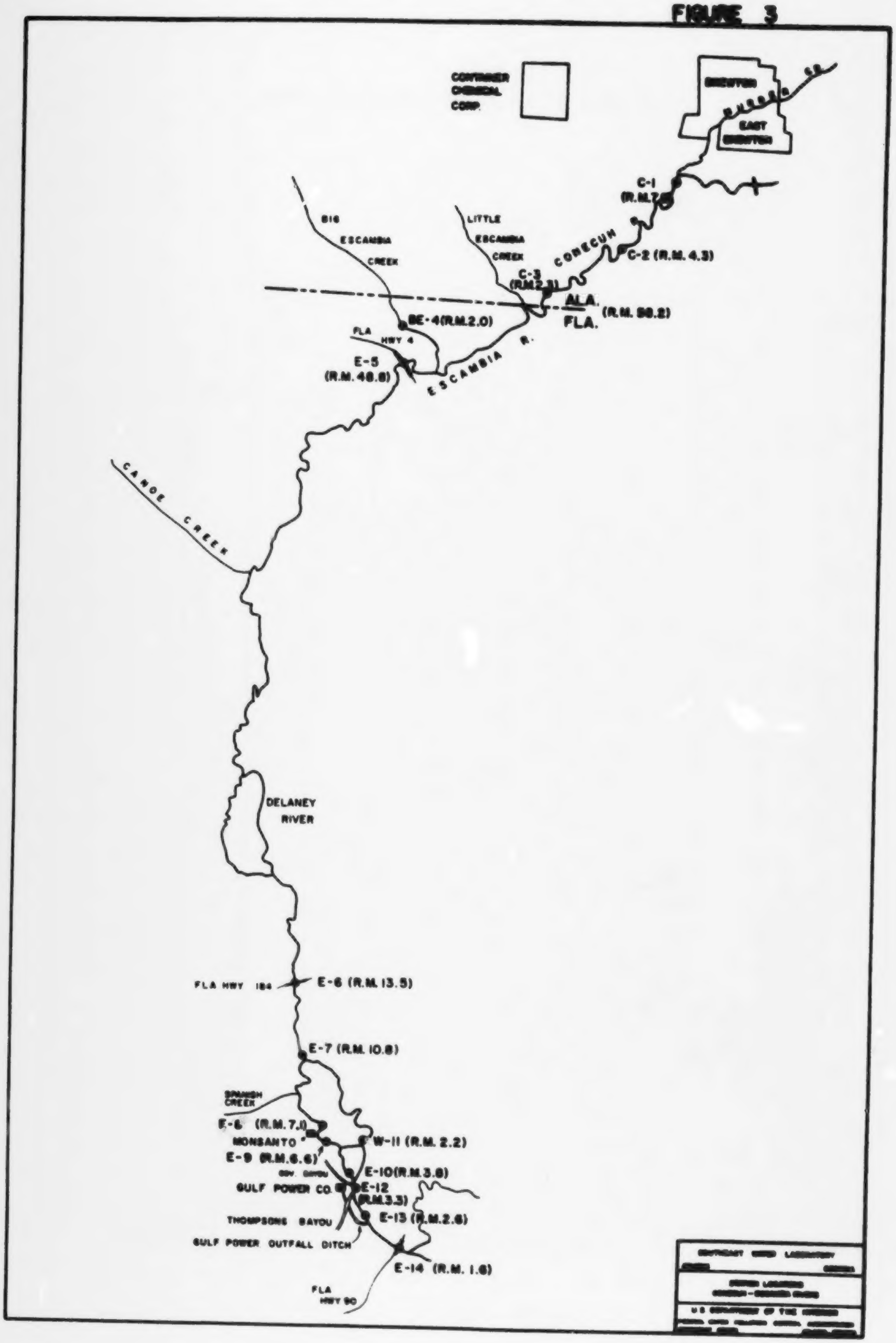
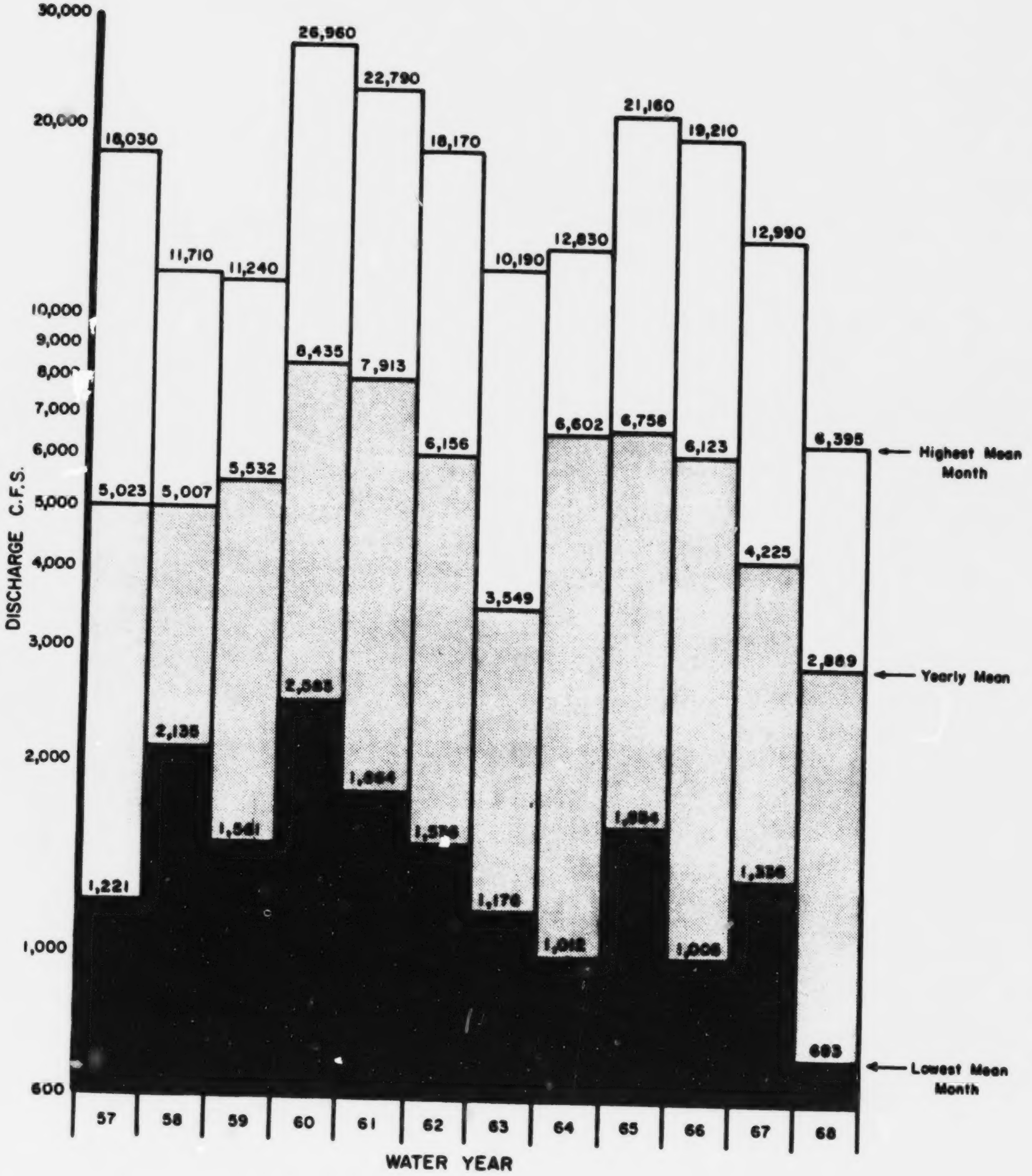

CONTAINER CHEMICAL CORP.
BREWTON
EAST BREWTON
MURDER CR.
C-1 (R.M.7.2)
LITTLE ESCAMBIA CREEK
CONECUH
C-2 (R.M. 4.3)
BIG ESCAMBIA CREEK
C-3 (R.M.2.3)
ALA.
FLA.
(R.M. 58.2)
BE-4 (R.M.2.0)
FLA HWY 4
E-5 (R.M. 48.8)
ESCAMBIA R.
CANOE CREEK
DELANEY RIVER
FLA HWY 184
E-6 (R.M. 13.5)
E-7 (R.M. 10.8)
SPANISH CREEK
E-8 (R.M. 7.1)
MONSANTO
E-9 (R.M.6.6)
W-11 (R.M. 2.2)
GOV. BAYOU
E-10 (R.M.3.8)
GULF POWER CO.
E-12 (R.M.3.3)
THOMPSONS BAYOU
E-13 (R.M.2.6)
GULF POWER OUTFALL DITCH
E-14 (R.M. 1.6)
FLA HWY 90
U S DEPARTMENT OF THE INTERIOR

FIGURE 4

ESCAMBIA RIVER NEAR CENTURY, FLORIDA



October 23, 1969 - 1510 cfs
October 24, 1969 - 1510 cfs
October 25, 1969 - 1510 cfs
October 26, 1969 - 1510 cfs
October 27, 1969 - 1400 cfs
October 28, 1969 - 1350 cfs

During late September 1969, prior to this study, heavy rains in the upper portion of the basin caused flooding conditions at Century. Flows increased from 914 cfs on September 19th to a flood crest of 11,600 cfs on September 24, 1969. In the reach of river from Century bridge upstream this flood scoured the bottom, resorted the sand and gravel substrate and had an unknown but undoubtedly drastic effect on the invertebrate fauna.

The Escambia River is characterized by an upper reach from Brewton, Alabama, to Molino, Florida, having moderate gradient (five feet per mile) and a lower section from Molino to the bay having negligible gradient (less than one foot per mile). The upper region of moderate gradient is characterized by swift current with steeply cut banks and a substrate changing from rocks and rubble in the upper reaches to sand and silt from the state line downstream.

From Molino downstream the current is sluggish and the river flows through low swampy areas with many sloughs and back waters. The substrate is soft and composed of a mixture of sand, silt and finely divided organic matter. Salt water penetration is dependent on river flow and during periods of low flow reportedly (3) may extend upstream a distance of approximately 8 miles from the mouth of the river (designating buoy #20 as mile zero).

Data on vertical profiles of salinity were collected from above the Monsanto Chemical Company outfall downstream to Highway 90 bridge between 12:00 noon and 1:00 pm on October 28, 1969 during a period of high slack tide. On October 28, the most upstream intrusion of salt was detected near the bottom of the river approximately 200 yards above the Monsanto barge dock at river mile 7.0 (Table 1, Figure 5). The salt water wedge, which terminated at river mile 7.0, exhibited salinities of 21.0 parts per thousand ($^o/oo$ near the bottom decreasing to 1.0 $^o/oo$ near the surface. From river mile 6.6 downstream to the Gulf Power effluent ditch (river mile 2.7) salinity in the upper 2 to 5 feet ranged from 1.0 to 3.0 $^o/oo$ (Figure 5). In this reach of river a sharp increase in the vertical salinity gradient occurred below a depth of seven feet terminating in a maximum salinity of approximately 21.0 $^o/oo$. As would be expected, the wedge of increasing salinity was nearer the surface at downstream stations.

TABLE 1

SALINITY ($^{o}/oo$) AT STATIONS ON THE ESCAMBIA RIVER - OCTOBER 28, 1969

DEPTH	200 Yards Above Monsanto Barge Landing R.M. 7.1	100 Yards Above Monsanto Barge Landing R.M. 7.1	1st Monsanto Outfall Pipe	Just Above Gas Line Crossing	Just Above White River Confluence
	MID	MID	MID	MID	MID
Surface	00.33	00.26	00.68	01.10	03.80
3'	00.33	00.26	00.77	01.46	04.02
6'	00.33	00.26	01.28	01.75	05.02
10'	00.33	00.26	19.48	21.16	20.06
13'	00.33	13.88	21.31	21.58	
16'		21.26		21.58	
19'		21.25			
22'		21.25			

TABLE 1 (Continued)

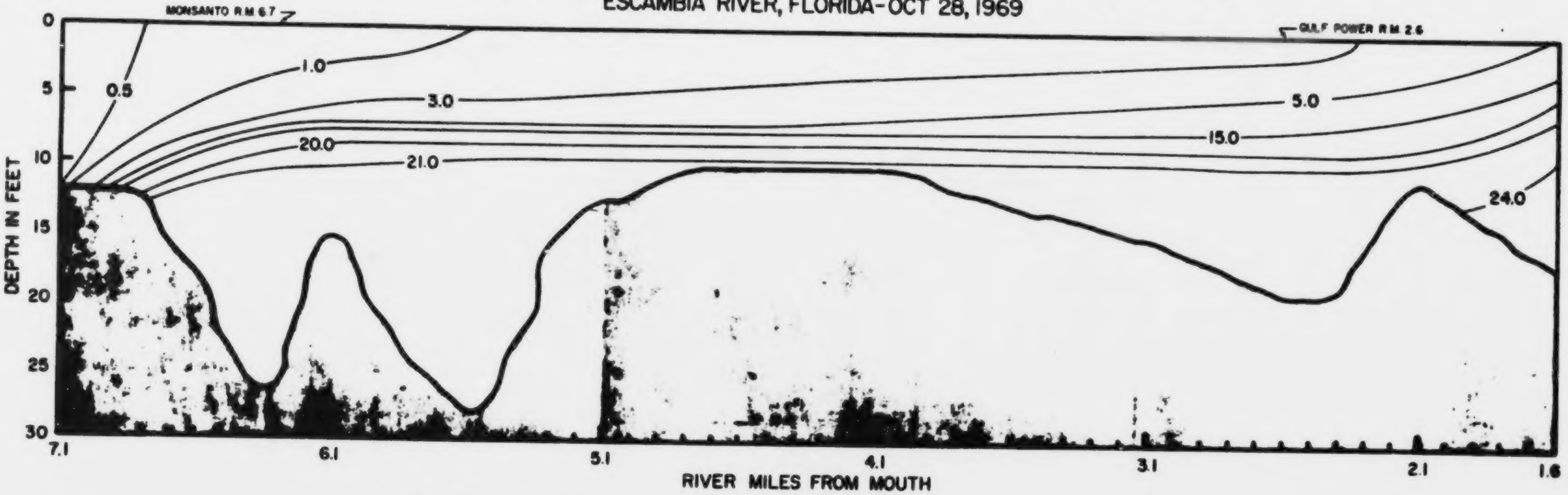
SALINITY ($^{o}/oo$) AT STATIONS ON THE ESCAMBIA RIVER - OCTOBER 28, 1969

DEPTH	Just Below White River Confluence			200 Yds. Below Gulf Power Outfall Ditch	Mouth of Escambia River - Left Fork Bouy # 22A
	LB	MID	RB	MID	MID
Surface	3.32	2.42	2.88	03.47	05.00
3'	4.46	4.68	4.70	04.26	12.46
6'	5.38	5.32	5.40	17.00	21.14
10'		19.98	21.96	22.17	24.78
13'			21.96	22.38	
16'					
19'					
22'					

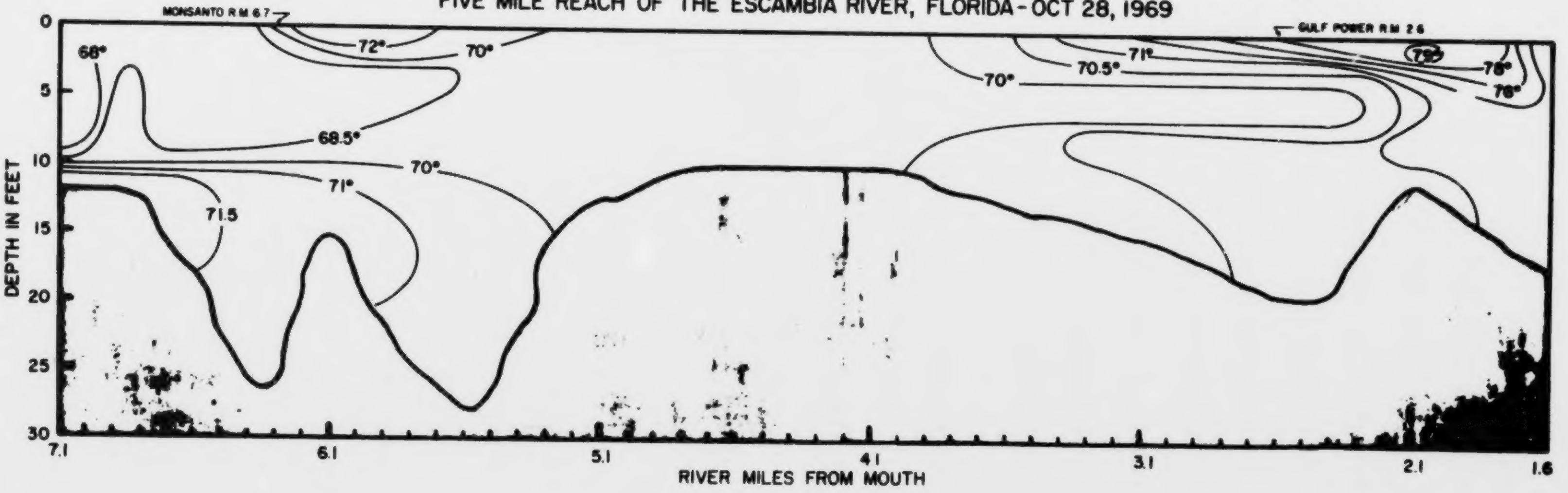
LEGEND: MID = Mid Channel
LB = Left Bank Looking Upstream
RB = Right Bank Looking Upstream

FIGURE 5

MID CHANNEL SALINITY (0/00) PROFILE ALONG A FIVE MILE STRETCH OF THE ESCAMBIA RIVER, FLORIDA-OCT 28, 1969



MID CHANNEL TEMPERATURE (°F) PROFILE SHOWING EFFECTS OF TWO HEATED EFFLUENTS ALONG A FIVE MILE REACH OF THE ESCAMBIA RIVER, FLORIDA-OCT 28, 1969



IV. WATER USE

A. ESCAMBIA BAY

Escambia Bay is a recreational as well as commercial center, utilized by fisherman, pleasure boaters and shellfish harvesters. Typical of most estuaries, it has provided a spawning ground and nursery for several species of aquatic life. The bay has also become an industrial center with extensive commercial water traffic in the channel. Wastes from municipal and industrial sources are discharged to Escambia River and Bay. Recreational and commercial fishing uses of the bay have declined in recent years.

Water Use Classification

All of Escambia Bay except the area east of the center of the bay and south of the L&N railroad bridge has been classified by the State of Florida as Class III; Recreation, Propagation and Management of Fish and Wildlife.

Requirements for this category are:

(1) Sewage and industrial wastes shall receive modern, effective treatment. This is interpreted by the State of Florida as requiring at least 90% removal of organic matter.

(2) Receiving waters shall not be caused to vary more than one unit on the pH scale from the normal background pH level. In no case will pH be less than 6.0 or greater than 8.5.

(3) Dissolved oxygen levels shall not be artificially depressed below 4.0 mg/l.

(4) Bacteria of the coliform group shall not exceed 1,000 per 100 ml as a monthly average (MPN or MF) nor exceed this value in more than 20% of the samples examined per month; nor shall it exceed 2400 per 100 ml on any day.

(5) No substances shall be present which are toxic or harmful to humans, animal or aquatic life.

(6) The water shall be free from materials attributable to municipal, industrial, agricultural and other discharges producing color, odor or other conditions in such degree as to create a nuisance.

(7) Turbidity shall not exceed 50 Jackson units above background.

(8) Temperature shall not be increased so as to cause damage to aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

The southeast portion of Escambia Bay below the L&N railroad bridge has been established as Class II; Shellfish Harvesting. The criteria for shellfish harvesting are similar to recreation values; the major difference being a more stringent bacteriological requirement. This criterion requires that the coliform group not exceed a median of 70/100 ml and should not exceed 230 per 100 mg/1 in more than 10% of the samples measured under the most unfavorable climate and hydrographic conditions.

Fishing and Recreation

Escambia Bay has been a prolific spawning ground for many species of fish, crab, shrimp and oyster. Among these, many species have important sport and commercial value including brown and white shrimp, mullet, menhaden, flounder, redfish, speckled trout and oysters. Numbers of white shrimp are markedly decreased in recent years. The disappearance of bottom grasses which offered a natural habitat for the shrimp has been theorized as the predominant cause of their declining numbers.[1] Sport fish, in general, appear to be present in fewer numbers in the bay in recent years.

At least 17 documented fish kills have occurred in the area over the past year.[2] Most of these kills occurred in Mulat-Mulatto Bayou. Several major kills also occurred in the northern section of Escambia Bay near the marsh flats.

A major fish kill in Mulat-Mulatto Bayou occurred in June 1969. FWPCA made an investigation of this particular kill at the request of the Governor of Florida. Results of the study showed that dissolved oxygen was greatly reduced in the bayou. It was concluded that the reduced dissolved oxygen and/or toxic material was responsible for the fish kill. The present study is the result of a recommendation, made in this report, for an extensive nutrient source survey in Escambia River and Bay (4). These conclusions and recommendations were presented to the Florida Department of Air and Water Pollution Control in July 1969.

There are at least four fish camp concessions on or near Escambia Bay (Lora Point, Mulat Bayou, Smith's Bayou and Escambia River). Three proprietors questioned are unanimous in their opinion that recreational use of Escambia Bay has been declining sharply in recent years. The proprietor of the most popular of the four establishments, Smith's Fish Camp, stated that he buys about $500 worth of live shrimp each year for use as bait for speckled trout, red fish and flounder. From five to seven years ago, he was purchasing $10,000 worth. His records for boat rentals show a similar decline over the same period.[3/] The Florida Game and Freshwater Fish Commission has estimated a decrease in fishing value in Escambia Bay of 80% since 1952 (5).

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[1] Written communication, Lt. Lewis E. Zangas, Florida Department of Natural Resources

[2] Written communication, Dr. Thomas Hopkins, Univ. of West Florida

Fishing licenses issued in Escambia County have increased approximately in proportion to the increase in population over the past nine years (about 18%). The large number of popular boating and fishing areas near the Gulf of Mexico and the Intracoastal Waterway have reportedly become preferred alternatives to Escambia Bay.

Although quantitative information on contact sports such as swimming and water skiing was not generally available, there is at least one commercial bathing beach on Escambia Bay. This concession near Lora Point has a docking facility, picnic pavilion and sand beach. Attendance figures for this facility were not available. Numerous private dwellings along the shores of the bay have docks for private boats and expanding residential development on the east side of Escambia Bay emphasize easy access to water through finger fill canals behind each home.

[3/] Written communication, Outdoor Editor, Pensacola News Journal

Shellfishing

Lower Escambia Bay, south of the railroad bridge and east of the bay's center line, is an approved area for oyster harvesting. Most of the area has been leased by commercial firms for private harvesting.

The two major commercial fishing concerns in the Pensacola area, American Seafood Company and Joe Patti Seafood Company, report a significant reduction in shrimp production in Escambia Bay. Nearly all shrimp harvesting in the bay is performed by these two companies. American Seafood reports production has decreased by about 80% in the past five years. A comparison of production for the months of May through June show a reduction from 162,540 pounds of shrimp for 1968 to 30,380 pounds in 1969. They also noted a "considerable" reduction of speckled trout and flounder for the past four years. The Joe Patti firm reports a decline in shrimp production from Escambia Bay for the first eight months of 1969 from 490,000 pounds to 110,000 pounds as compared to a similar period of 1968. They also indicate that white shrimp have virtually disappeared from the region and that brown shrimp have shown a considerable decline in number.[4/]

Industry and Commerce

The Monsanto Corporation and Gulf Power Company located on the Escambia River utilize barges to bring raw materials and fuel to their plants. Escambia River and Bay are also utilized as sources of cooling water by several of the industries located in the area. Finally, the estuary also is used as a means of waste discharge and conveyance for domestic and industrial wastes.

[4/] Written communication, Outdoor Editor, Pensacola News Journal

B. ESCAMBIA RIVER

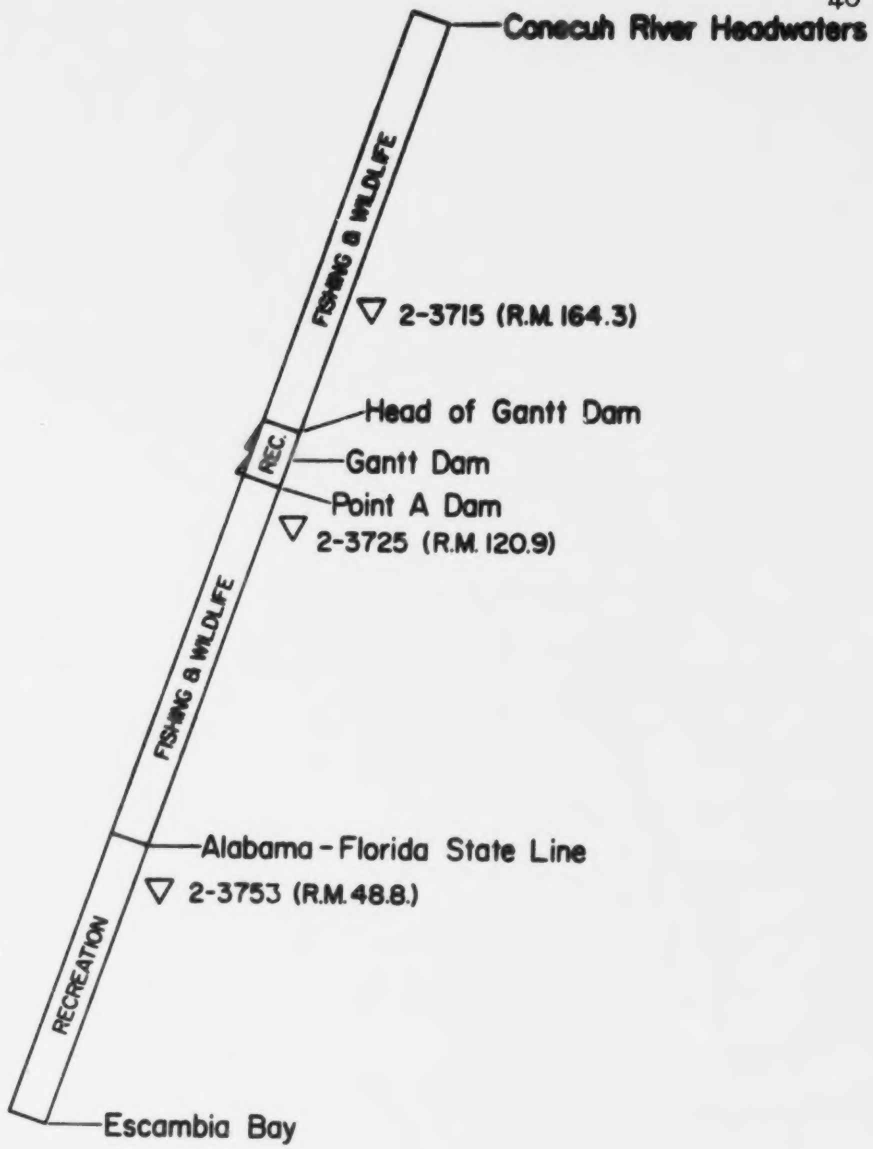
Water Use Classification

All of the Conecuh-Escambia River drainage is classified as Fish and Wildlife use in Alabama and Class III; Recreation, Fish and Wildlife in Florida (Figure 6).

Fishing and Recreation

The Conecuh-Escambia River in the area of the Alabama-Florida state line contains a very diversified fish population. In the lower region where the river is influenced by salt water from the bay, the population is less diversified. Among the fishes of importance to the sport and commercial fishermen are the largemouth and spotted bass, bluegill, crappie, warmouth, rock bass, white bass and channel catfish. The Florida Game and Freshwater Fish Commission in a comparison of fish collected with rotenone from the upper river in 1957 and 1967 reported a dramatic decrease in total numbers and total weight of fish over the ten-year period (6). During that period, there have been numerous fish kills reported, some of which have reached major proportions. Kills have been reported in both the upper and lower reaches of the river. During the past few years, the number of reported kills in the river has declined.

There are at least six commercial fish camps located along the river from Brewton, Alabama, to the mouth of the river. These camps sell bait and fishing gear, rent boats and provide access to the river. According to the Florida Game and Freshwater Fish Commission, 260 boats were licensed for hire in that area in 1962. In addition, on some weekends as many as 40-50 private boats are launched from each


Conecuh River Headwaters
FISHING & WILDLIFE
2-3715 (R.M. 164.3)
Head of Gantt Dam
REC.
Gantt Dam
Point A Dam
2-3725 (R.M. 120.9)
FISHING & WILDLIFE
Alabama - Florida State Line
2-3753 (R.M. 48.8.)
RECREATION
Escambia Bay

SCALE 1" = 10 MI.

CONECUH - ESCAMBIA RIVERS

camp each day. There are also several access sites along the river for which there are no records. In 1968-69 there were 101 boats launced from each site over the weekends. This is a reduction of some 60 per cent; however, there appears to be an increase in fisherman success in the past year according to personnel from the Florida Game and Fish Commission.

Industry and Commerce

The Conecuh-Escambia River from Brewton, Alabama, to Escambia Bay receives municipal wastes from Brewton, East Brewton and Flomaton in Alabama and Century in Florida. It receives industrial wastes from T. R. Miller Company, a lumber mill and wood preservative plant, Container Corporation of America, pulp and paper mill and drainage from the Pollard Oil Fields in Alabama. In Florida, the Monsanto Corporation and Gulf Power Company use the river for waste deposit and as a cooling water source. These two industries, also, use the river as a waterway for barging raw materials and fuel to their plants.

V. WASTE DISCHARGES

The major organic waste sources discharging to Escambia River and Bay are: Container Corporation of America at Brewton, Alabama; Monsanto Company; Escambia Chemical Company; American Cyanamid Company, and the Northeast sewage treatment plant of the City of Pensacola. In addition to these organic waste discharges, the Gulf Power Company and Monsanto Company release used cooling water to the lower reaches of the Escambia River at elevated temperatures. All of these sources except the Container Corporation are in the Pensacola metropolitan area.

Organic Wastes

The effects of organic waste effluents on quality of the receiving waters can be characterized by the carbon, nitrogen and phosphorus content. These three substances have both direct and indirect effects on the dissolved oxygen distribution. These interrelationships will be discussed more extensively in the water quality section of this report. A summary of data collected during the period September 10 to 20, 1969 is presented in Table 2.

Biochemical oxygen demand (BOD) is a measure of the quantity of oxygen that will be used in stabilizing the waste material in a stated period of time. The values presented are for a five-day period. Each pound of total organic carbon (TOC) discharged requires 2.67 pounds of oxygen from the receiving waters during stabilization to carbon dioxide. Total Kjeldahl nitrogen (TKN) is a measure of the

TABLE 2

SUMMARY OF WASTE DISCHARGES

Carbonaceous Material

Waste Source	Flow mgd***	Biochemical Oxygen Demand*			Total Organic Carbon		Theoretical Oxygen Demand	
		Pounds/ Day	P.E.**	% Contri- bution	Pounds/ Day	% Contri- bution	Pounds/ Day	% Contri- bution
Container Corp.	36.0	7,420	44,530	32.7	10,410	52.5	30,380	28.5
American Cyanamid	4.5	4,450	26,710	19.6	5,230	26.3	32,950	31.0
Escambia Chemical	5.2	290	1,740	1.3	194	1.0	15,470	14.6
Monsanto Chemical								
Main Outfall	50.6	8,670	52,000	38.1	3,805	19.2	18,500	17.5
Condensate Ditch	1.9	1,430	8,600	6.3	95	0.5	450	0.4
Total		10,100	60,600	44.4	3,900	19.7	18,950	17.9
N.E. Pensacola STP	1.0	457	2,740	2.0	129	0.7	8,050	7.6
		22,720	136,320		19,865		106,070	

* All BOD values are five day

** One population equivalent = 0.17 pounds per capita per day

*** Million gallons per day

TABLE 2 CONT'D

SUMMARY OF WASTE DISCHARGES

Nitrogenous Material

Waste Source	Total Kjeldahl Nitrogen Pounds/ Day	Total Kjeldahl Nitrogen % Contribution	Ammonia Nitrogen Pounds/ Day	Ammonia Nitrogen % Contribution	Nitrite-Nitrate N Pounds/ Day	Nitrite-Nitrate N % Contribution	Total N P.E.*
Container Corp.	495	4.3	193	3.2	3.4	0.1	20,450
American Cyanamid	4,160	36.2	538	8.8	693	15.7	198,850
Escambia Co.	3,270	28.5	2,280	47.2	2,380	53.9	231,700
Monsanto Chem. Co.							
Main Outfall	1,830	15.9	1,071	17.5	1,290	29.3	127,800
Condensate Ditch	42	0.4	33	0.5	41	0.9	3,400
Total	1,872	16.3	1,104	18.0	1,331	30.2	131,200
N.E. Pensacola STP	1,684	14.7	1,393	22.8	3.5	0.1	69,200
	11,475		6,108		4,409		651,400

* One population equivalent = .024 pounds per capita per day

TABLE 2 CONT'D

SUMMARY OF WASTE DISCHARGES

Phosphorus Material

Waste Source	Total Phosphate* Pounds/ Day	Total Phosphate* P.E.**	Total Phosphate* % Contribution	Ortho-Phosphate* Pounds/ Day	Ortho-Phosphate* % Contribution
Container Corp.	150	18,300	13.6	73	9.6
American Cyanamid	3.0	370	0.3	2.0	0.3
Escambia Chemical Co.	320	39,040	28.8	314	41.3
Monsanto Chemical Co. Main Outfall	354	43,190	32.0	250	32.9
Condensate Ditch	67	8,170	6.1	14	1.8
Total	421	51,360	38.1	264	34.7
N.E. Pensacola STP	213	25,990	19.2	107	14.1
	1107	135,060		760	

*as phosphorus

**one population equivalent = .008 pounds per capita per day total unsatisfied nitrogen as both nitrogen and ammonia. Each pound of this material reported as nitrogen requires 4.57 pounds of oxygen during stabilization to nitrates. The sum of these two values represents the theoretical amount of oxygen in the receiving water which is necessary to completely stabilize the unoxidized carbonaceous and nitrogenous content of the waste discharges. This is presented as the theoretical oxygen demand (TOD) by the relationship:

$$TOD = 2.67\ (TOC) + 4.57\ (TKN) \qquad (1)$$

where: TOD = theoretical oxygen demand

TOC = total organic carbon

TKN = total Kjeldahl nitrogen

This relationship is based on the assumption that all carbon will eventually be oxidized to carbon dioxide and all nitrogen will be oxidized to nitrate (7).

Phosphorus, as well as carbon and nitrogen, is a growth requirement for aquatic plants. Excessive phosphorus in the receiving water could stimulate both directly and indirectly excessive and undesirable populations of plankton and thereby upset the ecological balance among competing species. The ortho-phosphate form is that which is most readily acceptable for assimilation by plankton.

(A) Container Corporation of America

Container Corporation of America operates a bleached kraft pulp and paper mill at Brewton, Alabama. The plant discharges approximately 36 mgd of waste into a series of settling basins and natural ponds which provide about five days retention time before the effluent is discharged to Conecuh River about 50 miles upstream from the mouth of the Escambia River. In the settling ponds, pure oxygen is diffused into the waste. The average five-day BOD discharged to the Escambia River is 7,420 pounds per day, which is equivalent to the effluent produced by 44,530 people.[5] This accounted for 32.7% of the total BOD discharged. Container Corporation of America also discharged the largest quantity of TOC of any waste source in the study area; a mass of 10,410 pounds per day, which was 52.5% of the total.

This plant discharges 495 pounds per day of TKN, 193 pounds per day of ammonia nitrogen and 3.4 pounds per day of nitrite plus nitrate nitrogen, representing 4.3, 3.2 and 0.1%, respectively of these parameters. Although the total nitrogen discharge is small relative to other waste sources, it represents an equivalent population of 20,450.[6]

The waste loads of total and ortho-phosphates[7] are 150 and 73 pounds per day representing 13.6 and 9.6% of the total input, respectively. The total phosphorus discharge is equivalent to 18,300 PE.[8]

The TOD of this waste is 30,380 pounds per day or 28.5% of the total amount.

(B) Monsanto Company

Monsanto Company, a manufacturer of nylon fiber, injects 2.6 mgd of highly organic process and domestic waste into two deep strata wells, and discharges an average of 52.5 mgd of cooling water, boiler condensate and waste from their water treatment plant to the Escambia

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[5] 1 BOD_5 population equivalent = 0.17 pounds per day.

[6] 1 total nitrogen population equivalent = 9 pounds/year.

[7] All phosphates reported as Phosphorus (P).

[8] 1 total phosphorus population equivalent = 3 pounds/year.

River, about seven miles above the mouth. Two outfalls were monitored during the survey; the main outfall which was reportedly discharging cooling water, and the boiler condensate ditch. Data collected from these outfalls indicate that a highly significant quantity of process waste is being discharged with the cooling water and boiler condensate effluents.

The five-day BOD discharged from the plant is 10,100 pounds per day or 60,600 PE; which, at 44.4% of the total, is the largest waste source. The amount of TOC in the effluent is 3,900 pounds per day and 19.7% of the total contribution.

The quantity of TKN discharged by Monsanto is 1,875 pounds per day representing 16.3% of the total contribution. The total nitrogen population equivalent of this discharge is 131,200. The mass of ammonia nitrogen and nitrate plus nitrite nitrogen discharged are 1,104 pounds per day and 1,331 pounds per day, which were 18.0% and 30.2% of the total waste contribution in the study area.

Monsanto is also the most significant source of total phosphate contributing 38.1% of the total. The total phosphate discharged is 421 pounds per day or 51,360 PE. The contribution of ortho-phosphate is 264 pounds per day or 34.7% of the total.

The TOD of this discharge was 18,950 pounds per day, or 17.9% of the total.

(C) Escambia Chemical Company

Escambia Chemical is located on the northeastern shore of Escambia Bay, near Floridatown, Florida. Fertilizer, alcohol, ammonia and polyvinyl chloride are manufactured at this plant, which discharges about 5.2 mgd of waste through a swampy area. The retention time is estimated at two days. This source accounts for about one percent of both the five-day BOD and TOC discharged to the study area. However, it is the most significant source of nitrogen, contributing 47.2% of the ammonia nitrogen, 53.9% of the nitrite plus nitrate nitrogen and 28.5% of the TKN. Escambia Chemical Company discharges 2,380 pounds per day of nitrite plus nitrate nitrogen; more than all other sources combined. The quantity of TKN discharged is 3,270 pounds per day. The total nitrogen population equivalent of 231,700 is the largest quantity discharged to the study area, amounting to 35.6% of all sources.

A discharge of 320 pounds per day of total phosphate, or 39,040 PE, from Escambia Chemical accounted for 28.8% of the total. Ortho-phosphate, the most readily available form for algal assimilation, amounted to 310 pounds per day discharged, which is 41.3% of the total contribution, thus making Escambia Chemical Company the largest source of ortho-phosphate.

The TOD of the waste effluent from Escambia Chemical Company is 15,470 pounds per day, amounting to 14.6% of all discharges.

(D) American Cyanamid Company

American Cyanamid manufactures synthetic fibers at a plant located on the eastern shore of Escambia Bay just north of Mulatto Bayou. It discharges approximately 4.5 mgd of industrial and domestic waste, after primary treatment, to the bay through a 1,200 foot submerged outfall.

This waste source accounts for 19.6% of the five-day BOD and 26.3% of the TOC discharged. The five-day BOD discharged is 4,450 pounds per day or 26,710 PE. TOC discharged is 5,230 pounds per day.

American Cyanamid discharges 4,160 pounds per day of TKN or 36.2% of the total contribution, primarily in the form of organic nitrogen. American Cyanamid is the largest source of unstabilized organic nitrogen. The total nitrogen PE of this waste is 198,850, which is second only to that discharged by Escambia Chemical Company. About 8.8% of the ammonia nitrogen and 15.7% of the nitrite-nitrate nitrogen are discharged by American Cyanamid.

Phosphate discharged by American Cyanamid is negligible, amounting to only 0.3% of the total.

American Cyanamid discharges 32,950 pounds per day TOD. This is the largest single source of oxygen demanding material amounting to 31% of the total.

(E) Pensacola Northeast Sewage Treatment Plant

The Northeast sewage treatment plant is operated by the City of Pensacola and is the only waste source discharging principally domestic waste. This trickling filter plant is located on the western shore of Escambia Bay approximately two miles south of the I-10 bridge, where it discharges approximately one mgd of chlorinated secondary effluent through a submerged outfall. Immediately before the survey, wastes from Westinghouse and Ellyson Field Naval Air Station were intercepted and diverted to the Northeast sewage treatment plant. Construction to divert wastes from the Evergreen subdivision to this plant was in the last stages of completion at the time of the survey.

Carbonaceous waste discharged from this plant is insignificant compared to other waste sources amounting to no more than 2% of the total. The TKN and ammonia nitrogen discharges are 1,684 and 1,393 pounds per day, respectively. The population equivalent of the total nitrogen is 69,200 amounting to 14.7% of the TKN and 22.8% of ammonia nitrogen discharged from all sources. The quantity of nitrite plus nitrate nitrogen in the effluent is negligible.

The Northeast sewage treatment plant discharges 213 pounds per day or 25,990 PE of total phosphate and 107 pounds per day of orthophosphate. These values represent 19.2% and 14.1%, respectively, of the total contribution.

The effluent has the lowest TOD of 8,050 pounds per day, but still accounts for 7.6% of the total.

(F) Century, Florida

The community of Century, Florida, just south of the Alabama-Florida state line discharges untreated wastes from 50 to 60 homes, a sawmill and a small hospital. The effluent is to the swampy flood plain through which it flows approximately two miles to the Escambia River.

The total population equivalent of five-day BOD discharged to the study area is 136,320. The Monsanto Company discharges the largest mass of five-day BOD with Container Corporation of America and American Cyanamid also contributing significant quantities. These three sources account for 97% of the total. The total nitrogen discharged was equivalent to that produced by 651,400 persons. This is a massively excessive total compared to the domestic population. It is a significant cause of the water quality degradation of Escambia Bay by nutrient material. The most significant sources are Escambia Chemical discharging the largest quantity and American Cyanamid discharging slightly less. These two sources collectively discharge 430,550 PE or more than 66% of the total. When Monsanto's contribution of 131,200 is added, more than 86% of the total nitrogen is accounted. The total phosphorus population equivalent discharged was 135,060. All industries except American Cyanamid contributed significant amounts. Escambia Chemical and Monsanto collectively discharge 67% of the total. The relative waste discharges are illustrated in Figures 7, 8 and 9.

Of the 7,420 pounds per day of five-day BOD discharged by the Container Corporation of America at Brewton, Alabama, approximately 1,460 pounds per day of unstabilized material remain in the Escambia River when it becomes an estuary. With this reduction of organic materials in the river, above the bay, the Container Corporation contribution to the estuary is 8.9% of the total five-day BOD affecting water quality in Escambia Bay or 8,760 PE. The relative percent contribution of five-day BOD of Monsanto to the estuary is increased to 60.3% of the total, with the contribution of all other waste sources increasing slightly to compensate for the Container decrease. The five-day BOD contributions directly affecting water quality in the estuary are presented in Table 3. The total population equivalent of five-day BOD reaching the estuary from waste sources is 100,550.

The amount of nitrogenous waste discharged to the estuary is approximately the same as the total from all waste sources, since

FIGURE 7

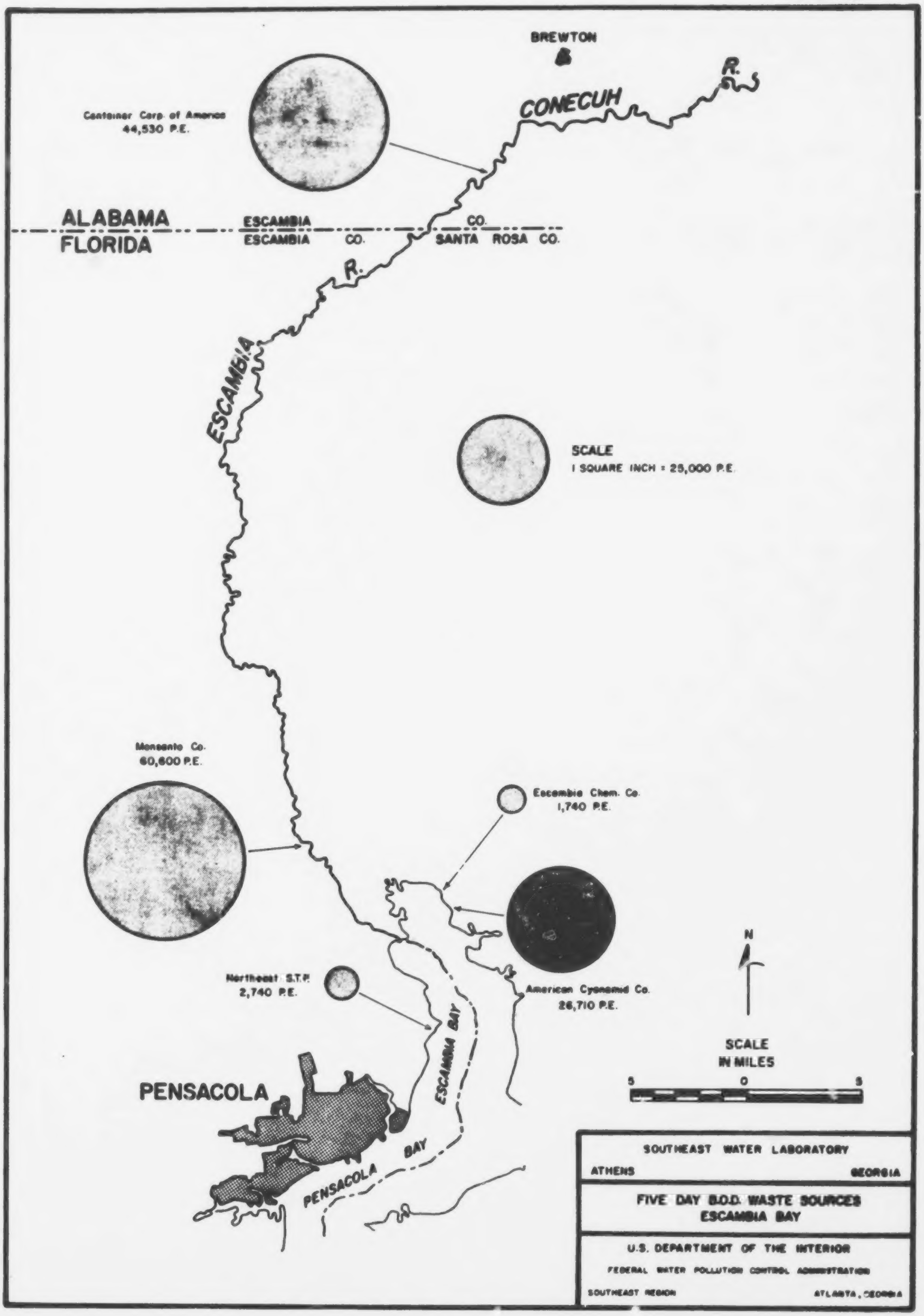
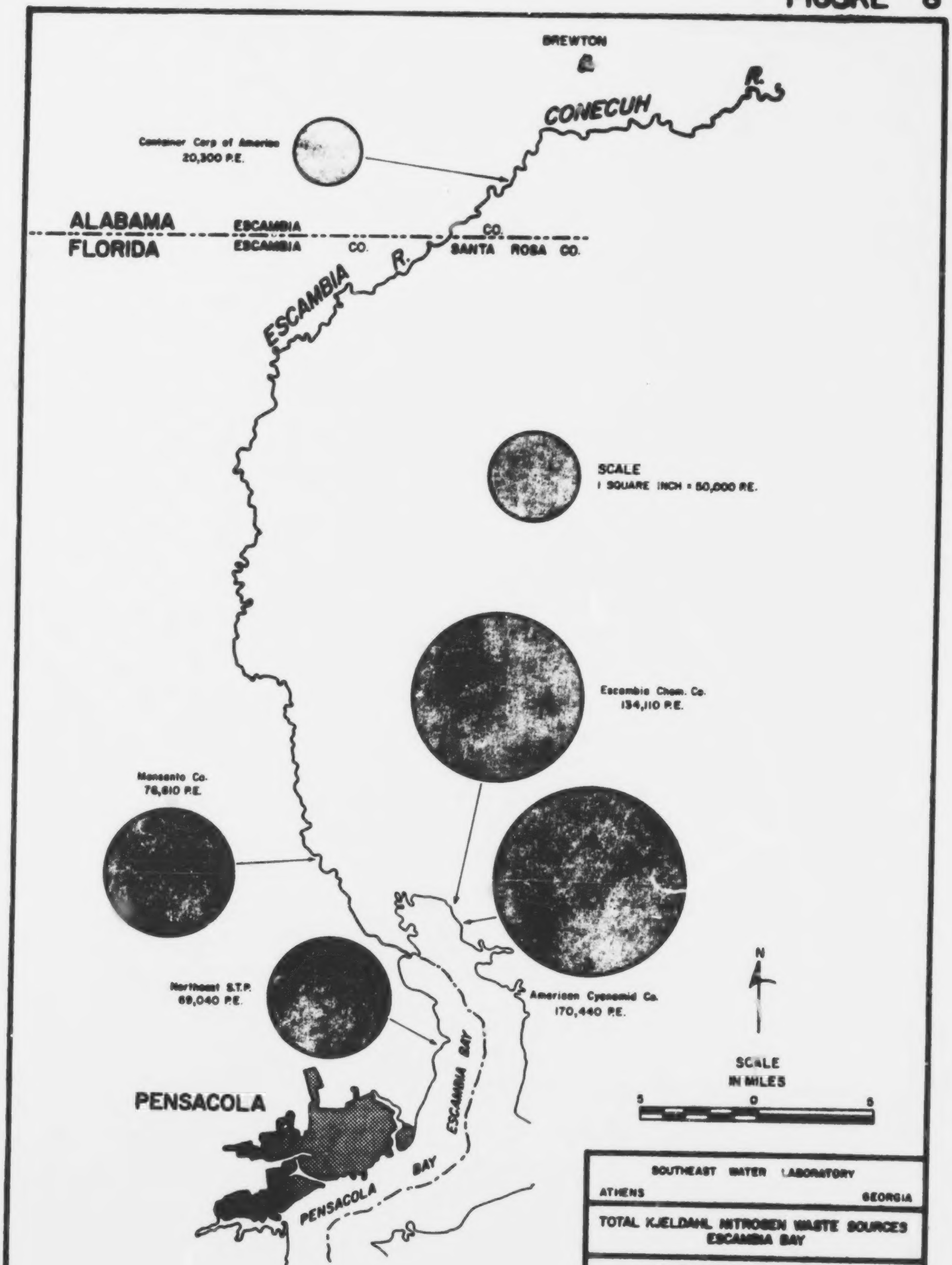

BREWTON
CONECUH
R.
Container Corp. of America
44,530 P.E.
ALABAMA
FLORIDA
ESCAMBIA
CO.
ESCAMBIA
CO.
SANTA ROSA CO.
R.
ESCAMBIA
SCALE
1 SQUARE INCH = 25,000 P.E.
Monsanto Co.
60,600 P.E.
Escambia Chem. Co.
1,740 P.E.
N
Northeast S.T.P.
2,740 P.E.
American Cyanamid Co.
26,710 P.E.
ESCAMBIA BAY
SCALE
IN MILES
5
0
5
PENSACOLA
PENSACOLA
BAY
SOUTHEAST WATER LABORATORY
ATHENS
GEORGIA
FIVE DAY B.O.D. WASTE SOURCES
ESCAMBIA BAY
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION
ATLANTA, GEORGIA

FIGURE 8

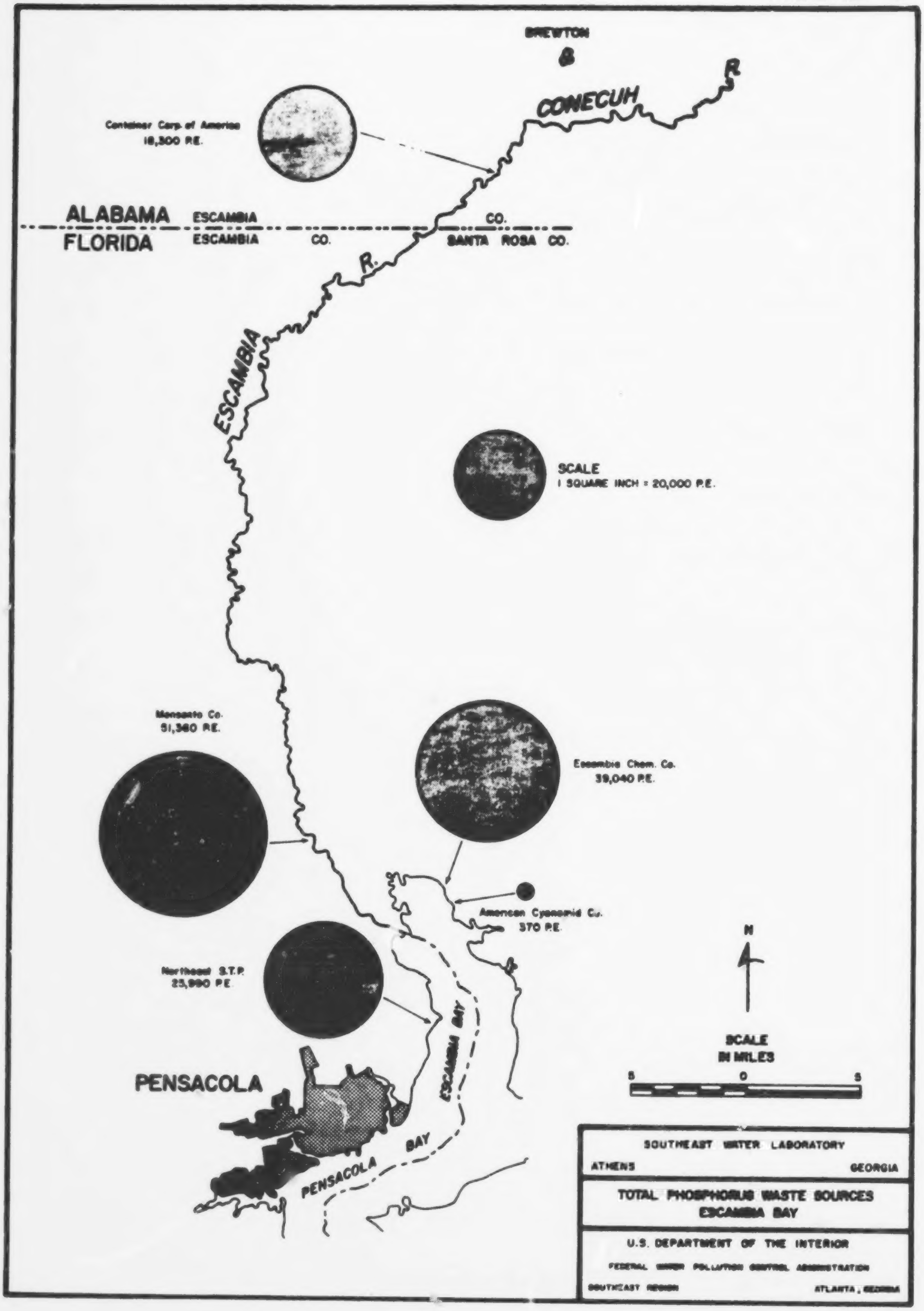

BREWTON
CONECUH
R.
Container Corp of America
20,300 P.E.
ALABAMA
FLORIDA
ESCAMBIA
ESCAMBIA CO.
CO.
SANTA ROSA CO.
ESCAMBIA
R.
SCALE
1 SQUARE INCH = 50,000 P.E.
Escambia Chem. Co.
134,110 P.E.
Monsanto Co.
76,610 P.E.
Northeast S.T.P.
69,040 P.E.
American Cyanamid Co.
170,440 P.E.
N
SCALE
IN MILES
5
0
5
PENSACOLA
ESCAMBIA BAY
PENSACOLA BAY

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

TOTAL KJELDAHL NITROGEN WASTE SOURCES
ESCAMBIA BAY

U.S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 9


BREWTON
CONECUH
R.
Container Corp. of America
18,300 P.E.
ALABAMA
ESCAMBIA
CO.
FLORIDA
ESCAMBIA
CO.
SANTA ROSA CO.
R.
ESCAMBIA
SCALE
1 SQUARE INCH = 20,000 P.E.
Monsanto Co.
51,360 P.E.
Escambia Chem. Co.
39,040 P.E.
American Cyanamid Co.
370 P.E.
Northeast S.T.P.
25,990 P.E.
N
ESCAMBIA BAY
PENSACOLA
PENSACOLA BAY
SCALE
IN MILES
5
0
5

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

TOTAL PHOSPHORUS WASTE SOURCES
ESCAMBIA BAY

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

TABLE 3

WASTE SOURCE BOD$_5$ CONTRIBUTION TO THE ESCAMBIA ESTUARY

Waste Source	Pounds/ Day	Population Equivalents	Percent Contribution
Container Corp.	1,460	8,760	8.7
American Cyanamid	4,450	26,710	26.6
Escambia Chemical Co.	290	1,740	1.7
Monsanto Chemical Co.	10,100	60,600	60.3
Northeast sewage treatment plant	457	2,740	2.7
TOTAL	16,757	100,550	

Container Corporation's nitrogenous discharge is relatively insignificant compared to other waste sources.

Since only slight reduction in phosphates is expected to occur in the Escambia River from Brewton to the bay, the quantity of phosphorus discharged to the estuary would also be approximated by the total from all waste sources.

Toxic Wastes

Effluent samples were collected from the Monsanto Company, Escambia Chemical Company and the American Cyanamid Company for examination for suspected specific complex compounds which may be toxic to aquatic life. Gas chromatograph and mass spectroscopy analyses were made on each sample.

In the Monsanto effluent, no compounds were present greater than 5.0 milligram per liter (mg/l). Polychlorinated biphenyl compounds (PCB) were not detected at a sensitivity of 1 part per billion (ppb) in any of the three Monsanto samples. However, diphenyl oxide, known as phenyl ether, was present at an estimated concentration between 20 and 50 ppb in the sample collected from the north outfall. Diphenyl oxide is used as a heat transfer medium and may be implicated in odor problems from boiler blowdown. The toxicity of this substance to aquatic life has not been determined.

No compound in the Escambia Chemical effluent had concentrations greater than 5 mg/l. This sample was also analyzed for methanol which was not present at 1 mg/l. All other compounds analyzed have a 5 mg/l limit.

The American Cyanamid effluent sample contained acrylonitrile at a concentration of about 100 mg/l. Acrylonitrile is a monomer used in acrylic fiber. This compound is known to be highly toxic to rodents and has been used as a fumigant for insect control. Acrylonitrile has a higher lethal death capability than DDT for rats. Furthermore, acrylonitrile, unlike DDT, is moderately soluble in water. In fish toxicity studies, a concentration of 30 milligrams per liter (mg/l) caused 100% mortality to pin perch, a marine fish (8). Lesser concentrations resulted in lesser mortalities.

In addition to acrylonitrile, American Cyanamid also reportedly discharges 180 to 190 mg/l of sodium thiocyanate which is used as a solvent. Sodium thiocyanate is basically a very stable compound with high solubility. In the presence of chlorine, it breaks down to release cyanide, an extremely toxic substance to any aquatic life. However, such an occurrence would be highly unlikely unless one of the immediate waste sources discharges free chlorine.

Although it has not been directly demonstrated, the results of these analyses indicate that the wastes from American Cyanamid may be directly responsible for some of the fish kills in the northeast section of Escambia Bay. Consequently, it is recommended that the American Cyanamid Company immediately reduce concentrations of acrylonitrile in its waste effluent to levels less than 10% of that which is toxic to fish. Further investigations should be made to determine whether American Cyanamid or Escambia Chemical ever discharge free chlorine.

Thermal Pollution

Monsanto Company and Gulf Power Company at river mile 6.7 and 2.6, respectively, discharge large quantities of heated water after use for cooling purposes. The volume of Monsanto and Gulf Power discharges are approximately 50 million gallons per day (mgd) and 150 mgd, respectively.

To obtain an estimate of the effect of these discharges on the temperature regime of the lower portion of the river data on vertical and horizontal profiles of water temperature were collected from above the Monsanto Chemical Company outfall downstream to just below Highway 90 bridge (Table 4 and Figure 5).

The mean daily flow at Century on October 28 was 1350 cfs. Sampling was begun at the upper stations during high slack tide and by the time samples were collected at the lower stations there was a strong ebb tide running.

Surface waters immediately adjacent to the Monsanto outfall ditch were increased 19.5°F over the background temperature of the river immediately above the outfall. The heated effluent lies near the surface and water temperature returns to near ambient below a depth of six feet.

One hundred yards below the Monsanto outfall most of the heated water is near the surface on the left bank and has a maximum temperature of 81°F (Figure 10) and is 13°F over background. At a distance 300 yards below the outfall the heated effluent is well mixed horizontally with a surface temperature of 75°F (Figure 11). At this point the heated water is in the surface two feet of water.

TABLE 4

WATER TEMPERATURE (^{o}F) AT STATIONS ON THE ESCAMBIA RIVER - OCTOBER 28, 1969

DEPTH	R.M. 7.1			200 Yards Above Monsanto Barge Landing			Adjacent To 1st Monsanto Outfall Pipe	Big Bend 100 Yards Below 2nd Outfall Pipe
	LB	MID	RB	LB	MID	RB	MID	MID
Surface	68.0	68.0	68.0	68.0	68.0	68.0	68.5	68.5
2'	68.0	68.0	68.0	68.0	68.0	68.0	68.75	68.5
4'	68.0	68.0	68.0	68.0	68.0	68.0	68.75	68.5
6'	68.0	68.0	68.0	68.0	68.0	68.0	68.75	68.5
8'	68.0	68.0	68.0	68.0	68.0	68.0	68.75	68.5
10'	68.0	68.0	68.0	68.0	68.0	68.0	68.75	71.0
12'	68.0	68.0	68.0	71.5		71.5	71.5	71.5
14'							71.5	71.5
16'								71.5
18'								71.5
20'								
22'								
24'								
26'								

LEGEND:
LB = Left Bank Looking Upstream
MID = Mid Channel Looking Upstream
RB = Right Bank Looking Upstream

TABLE 4 (Continued)

WATER TEMPERATURE (^{o}F) AT STATIONS ON THE ESCAMBIA RIVER - OCTOBER 28, 1969

DEPTH	STATION							
	75 Yds. Above Main Outfall Ditch	10 Yds. Offshore at Monsanto Outfall Ditch R.M. 6.7	100 Yds. Below Monsanto Outfall Ditch			300 Yds. Below Monsanto Outfall Ditch		
	MID	MID	LB	MID	RB	LB	MID	RB
Surface	68.5	87.5	71.0	74.0	81.0	75.0	75.0	75.0
2'	68.5	76.5	70.0	70.0	75.0	71.0	71.0	71.5
4'	68.5	72.0	69.5	68.5	72.0	70.0	68.5	70.0
6'	68.5	68.5	69.0	68.5	69.0	69.0	68.5	70.0
8'	68.5	68.5	68.5	68.5	68.5	68.5	69.5	69.5
10'	71.0	68.5	71.0	71.0	71.0	71.0	71.0	71.0
12'	71.25	71.5	71.0	71.0	71.0		71.0	71.0
14'	71.25	71.5	71.0	71.0			71.0	71.0
16'	71.25	71.5	71.0	71.0			71.0	
18'	71.25	71.5	71.0	71.0			71.0	
20'	71.25	71.5	71.0	71.0				
22'			71.0					
24'			71.0					
26'			71.0					

TABLE 4 (Continued)

WATER TEMPERATURE (^{o}F) AT STATIONS ON THE ESCAMBIA RIVER - OCTOBER 28, 1969

DEPTH	STATION 600 Yds. Below Monsanto Outfall Ditch at Gas Line Crossing	900 Yds. Below Monsanto Outfall Ditch	1200 Yds. Below Monsanto Outfall Ditch	1700 Yds. Below Monsanto Outfall Ditch
	MID	MID	MID	MID
Surface	73.5	73.0	70.5	70.0
2'	70.0	70.0	69.5	69.5
4'	68.5	68.5	69.5	69.5
6'	68.5	69.0	69.5	69.5
8'	68.5	69.0	69.5	69.5
10'	71.0	70.75	70.0	70.0
12'	71.0	70.5	70.0	70.0
14'	71.0	70.5	70.25	70.0
16'	71.0	70.5	70.5	70.0
18'	71.0	70.5	70.25	
20'	71.0	70.5	70.5	
22'	71.0	70.5	70.5	
24'			70.5	
26'			70.5	
28'			70.5	

TABLE 4 (Continued)

WATER TEMPERATURE (^{O}F) AT STATIONS ON THE ESCAMBIA RIVER - OCTOBER 28, 1969

DEPTH	R.M. 3.5 Just Below White River	100 Yds. Below Gulf Power Ditch			600 Yds. Below Gulf Power Ditch			100 Yds. Above Rt. 90 Hiway Bridge		
	MID	LB	MID	RB	LB	MID	RB	LB	MID	RB
Surface	70.25	82.5	78.0	70.25	81.0	78.0	71.5	77.5	72.0	72.5
2'	70.25	82.0	72.0	70.25	80.0	79.0	70.75	77.5	71.25	71.5
4'	70.0	82.0	70.0	70.25	75.0	70.5	70.25	78.0	76.00	71.5
6'	70.0	79.5	70.0	70.25	72.5	70.5	71.0	71.5	71.5	70.75
8'	70.5	71.0	70.75		70.5	70.75	70.5	71.0	71.5	70.75
10'	70.25	71.0	70.5			70.50	70.5		71.0	70.75
12'	70.25	70.5	70.5				70.5		71.0	71.0
14'	70.25	70.5	70.5						71.0	71.25
16'		70.5	70.5						71.0	
18'		70.5								
20'		70.5								
22'										
24'										
26'										
28'										

FIGURE 10

TEMPERATURE (°F) PROFILE 100 YDS. BELOW MONSANTO OUTFALL DITCH, R.M. 6.3
ESCAMBIA RIVER, FLORIDA - OCT 28, 1969

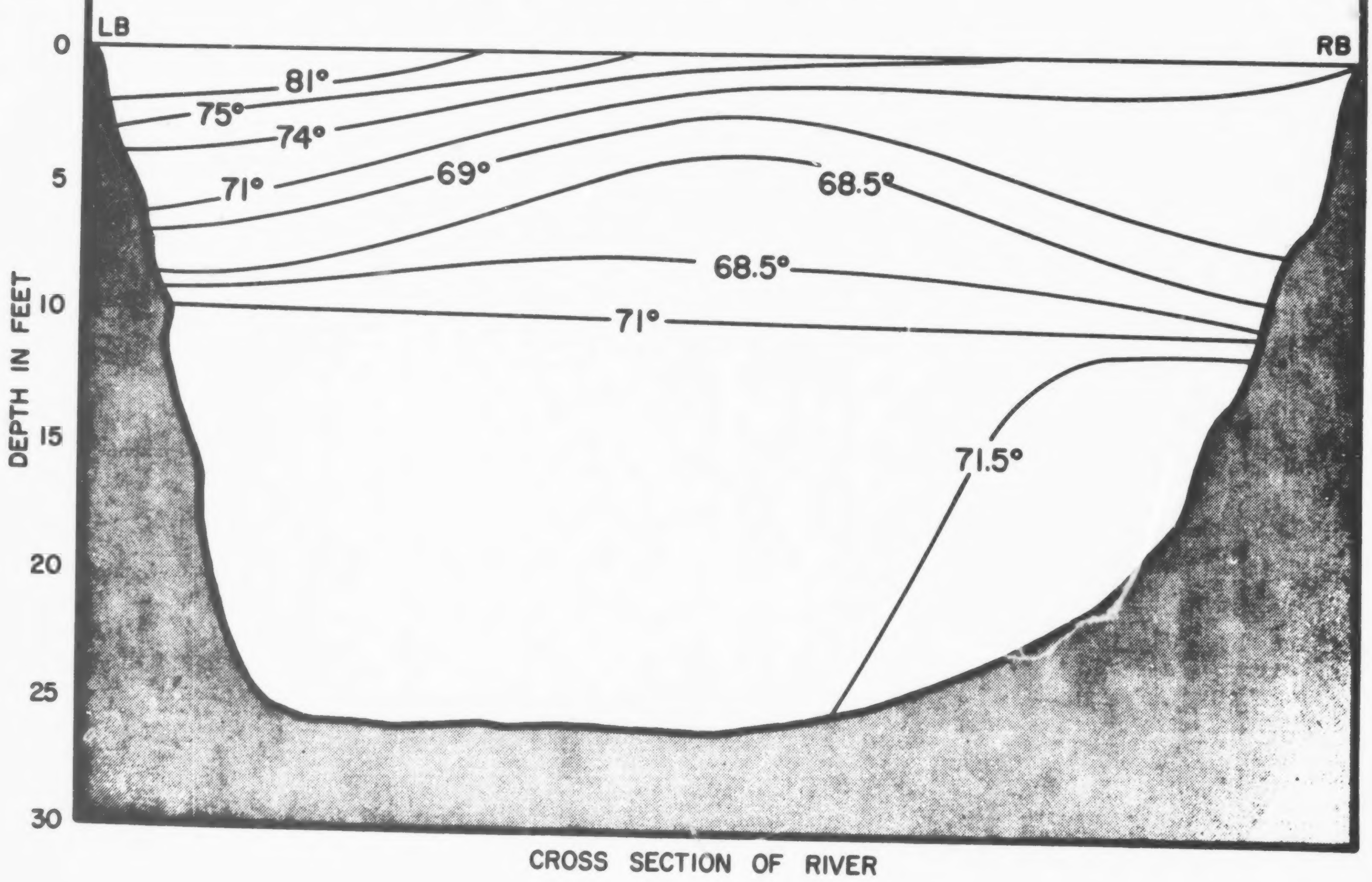
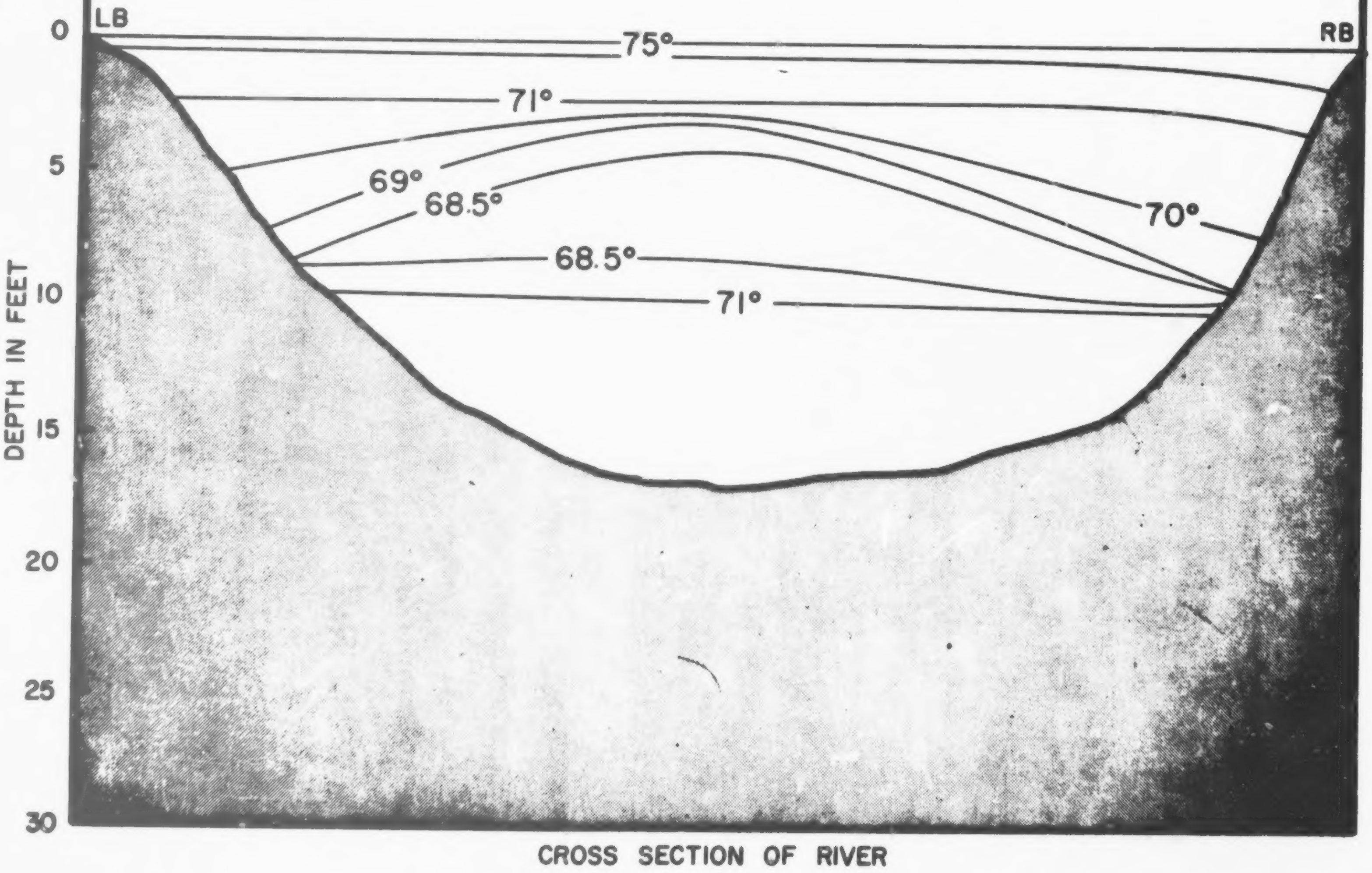


FIGURE 11

TEMPERATURE (°F) PROFILE 300 YDS. BELOW MONSANTO OUTFALL DITCH R.M. 6.1
ESCAMBIA RIVER, FLORIDA - OCT 28, 1969



An unusual feature of the temperature regime in the upper section of river is the layer of warmer water near the bottom (Figure 5). Water near the bottom was found to be 3.0 to 3.5°F warmer than the surface water. On the basis of present data, it appears that this layer of warmer water coincides with the salt water wedge moving upstream from the bay. Solar heating of the quiescent bay waters combined with the heat added near the bay mouth by the effluent from Gulf Power would appear to be the most reasonable hypothesis to explain the elevated temperature of the saline wedge.

The Gulf Power effluent increases river temperature from 70.25°F to 82.5°F or 12.25° over background (Figure 12). This heated effluent clings to the left shoreline in the upper six feet of water and is still evident at Highway 90 bridge (1.0 mile below the effluent ditch) where the upper six feet of water along the right quarter of the river is still 7.25°F above temperatures of the river immediately above Gulf Power Company (Figure 13).

The effect of these elevated temperatures on biological life in the Escambia River has not been directly ascertained since there are other factors, such as discharge of organic wastes and physical variations in flow and natural sediment load, which could cause deleterious alterations in the biological community. The National Technical Advisory Committee to the Secretary of the Interior has recommended that water temperature in estuaries should not be increased more than 4°F from September to May nor more than 1.5°F during June through August (9). On this basis, both Monsanto Company and Gulf Power Company are discharging thermal pollution to the Escambia River and should abate this pollution.

FIGURE 12

TEMPERATURE (°F) PROFILE 100 YDS. BELOW GULF POWER OUTFALL DITCH AT R.M. 2.6 ESCAMBIA RIVER, FLORIDA - OCT 28, 1969

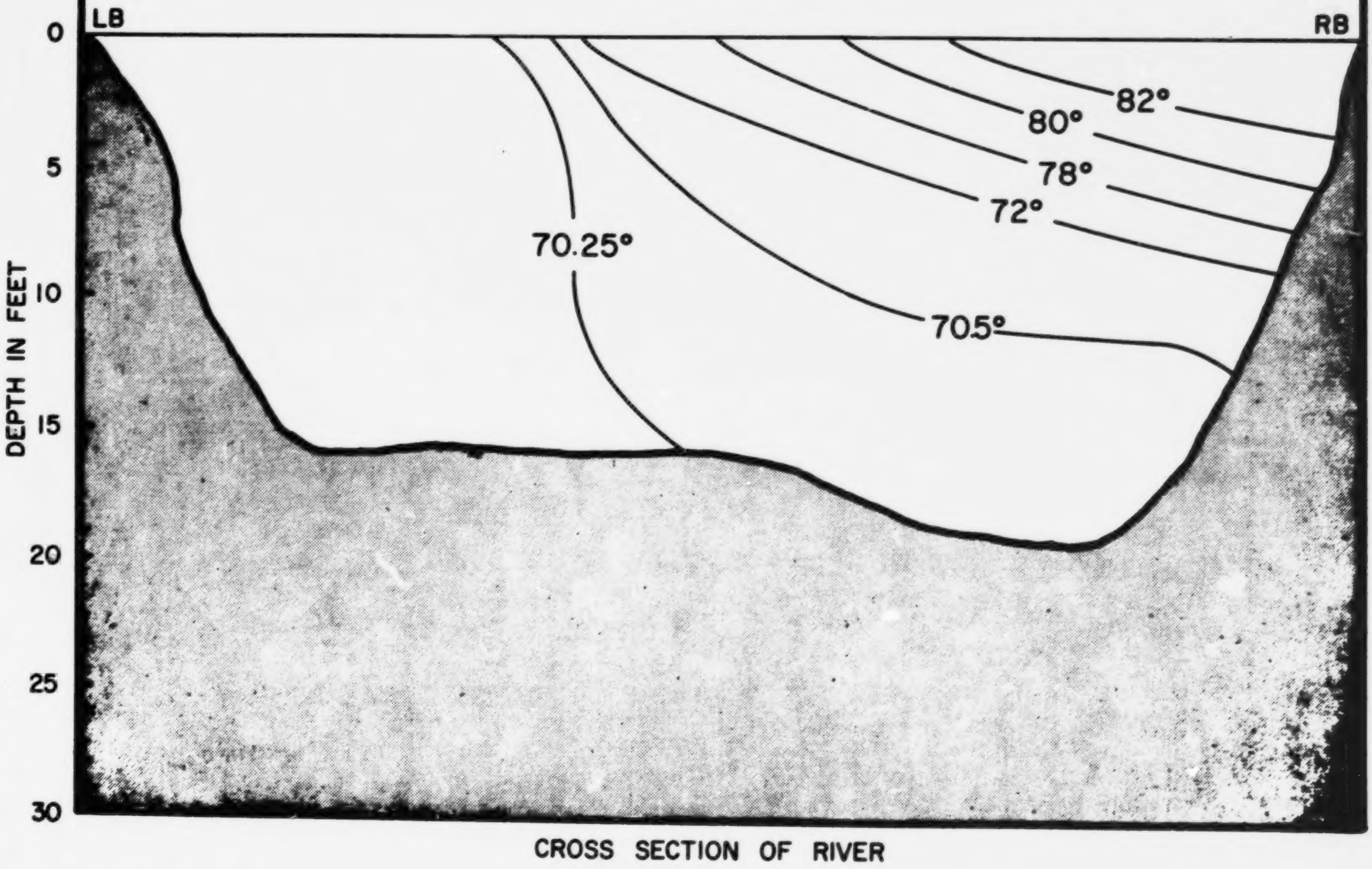
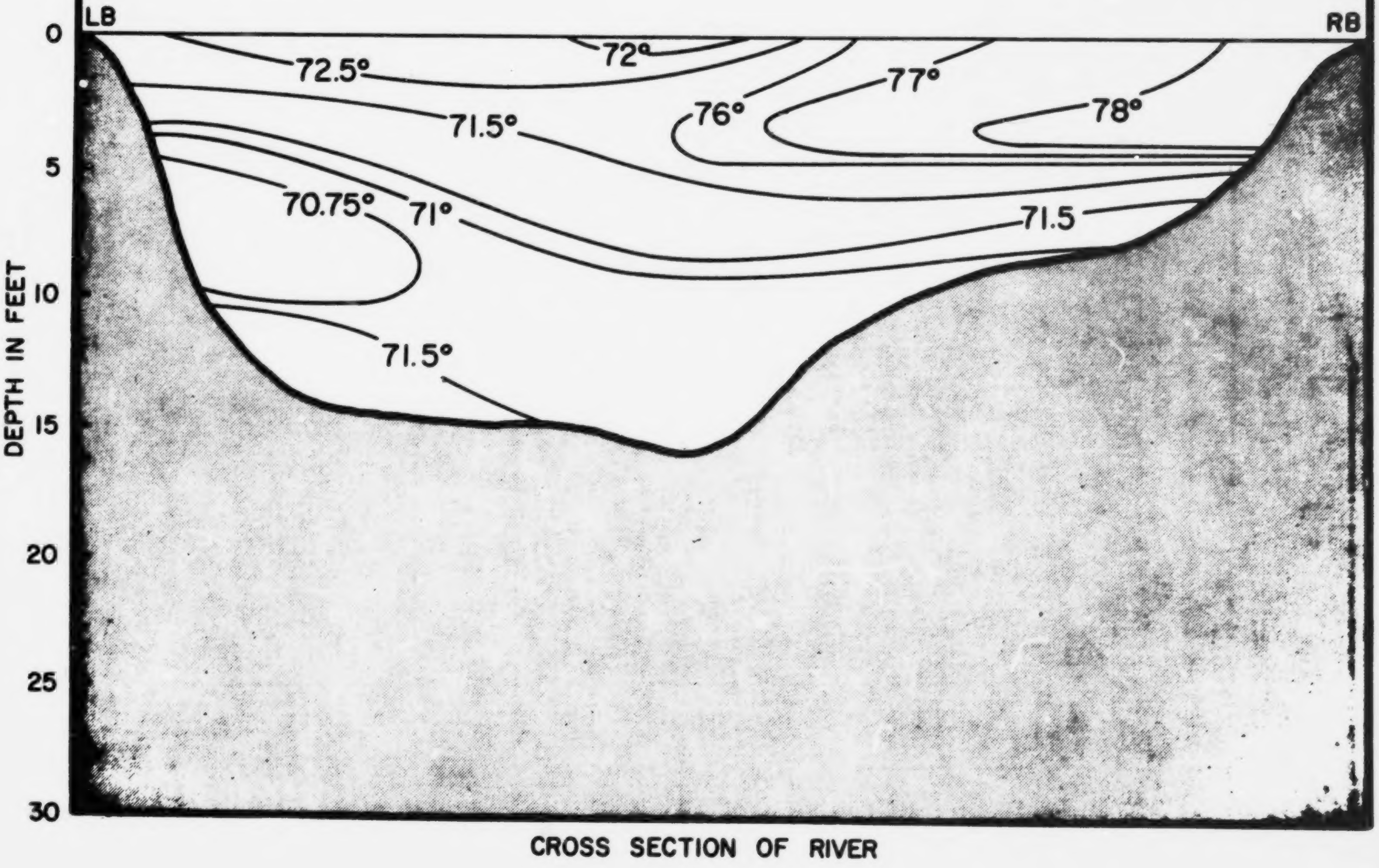


FIGURE 13

TEMPERATURE (°F) PROFILE 100 YDS. ABOVE HIWAY 90 BRIDGE AT R.M. 1.7 ESCAMBIA RIVER, FLORIDA - OCT 28, 1969



VI. WATER QUALITY

ESCAMBIA BAY

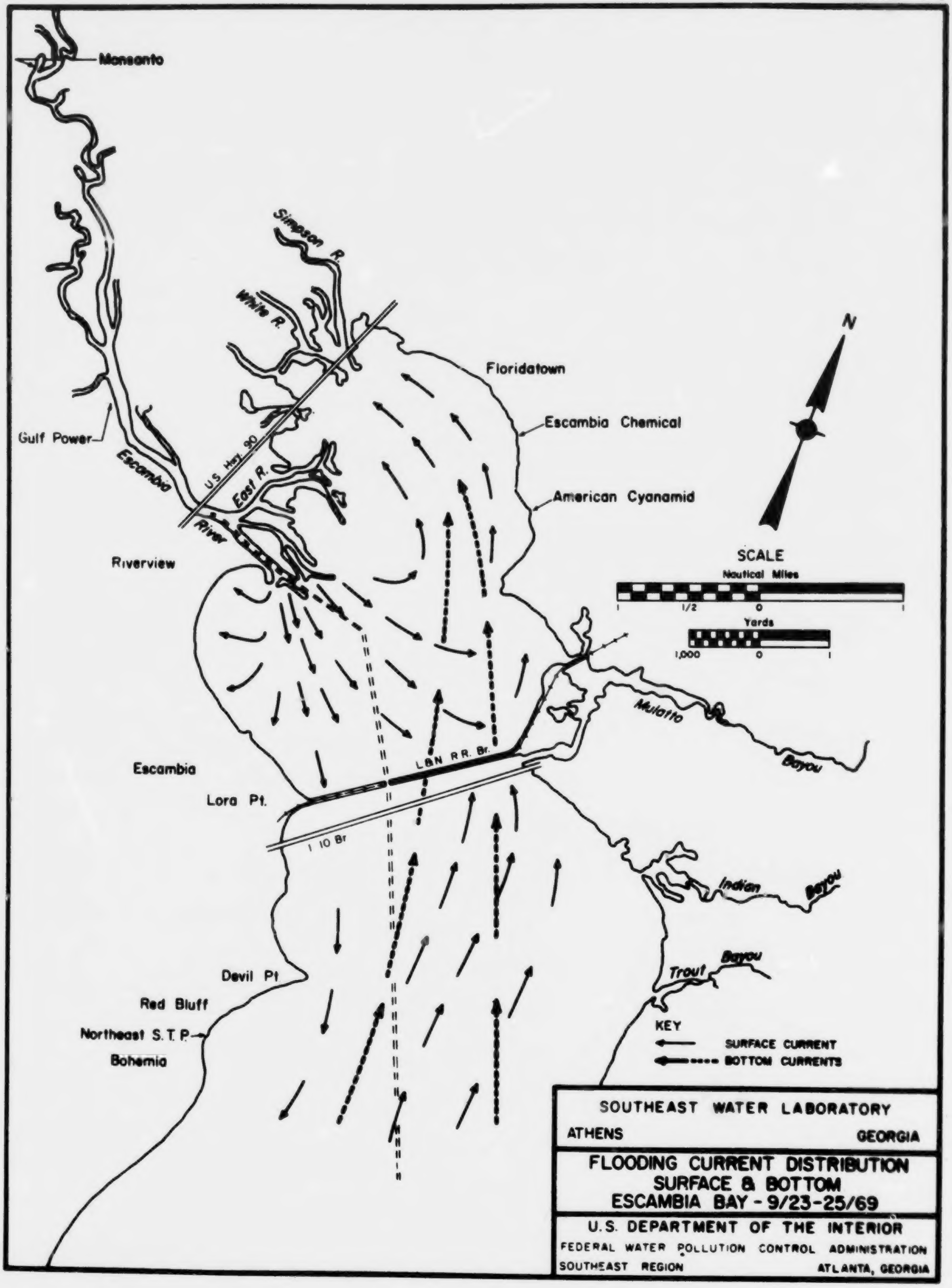
1) Current Movement

Since chlorides are inorganic and do not decay with time, examination of the chloride profiles in an estuary provides information on water movement and waste distribution. The only factors which could cause variations in chloride concentration at a particular point, are turbulent dispersion due to the tidal currents and advection caused by fresh water inflow, principally from the Escambia River. The volume of this fresh water inflow as well as the physical configuration of the bay also determine the amount of time it takes to flush wastes from Escambia Bay.

Figures 14 and 15 show the predominant current patterns in Escambia Bay derived from chloride analyses at 28 locations, collected ten times at each location synoptically, during the period September 23 through 25, 1969.

On the flooding current, fresh water discharge from the Escambia River disperses over the surface of the bay in the general direction of the eastern shore north of the L & N railroad bridge. More saline water from Pensacola Bay moves northward on the bottom along the eastern shore and prevents the fresh water from being flushed. Water in the bay below the railroad bridge moves in a northeast direction toward Mulatto Bayou and the water on the eastern shore above the bridge and adjacent to American Cyanamid and Escambia Chemical, is pushed into the relatively stagnant marshy

FIGURE 14

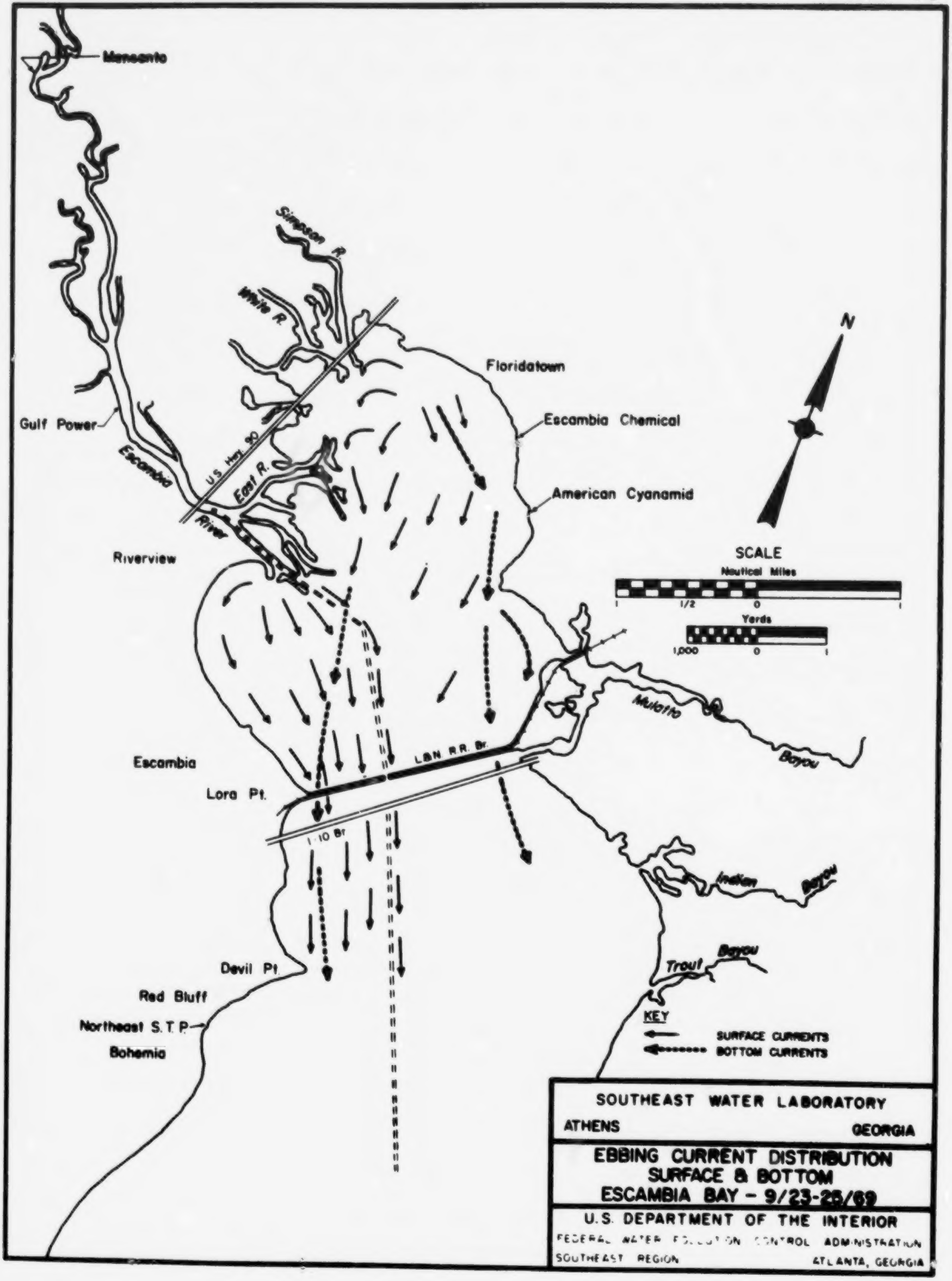

Monsanto
Simpson R.
White R.
Floridatown
Escambia Chemical
Gulf Power
Escambia River
U.S. Hwy. 90
East R.
American Cyanamid
N
Riverview
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1
Mulatto Bayou
Escambia
L&N R.R. Br.
Lora Pt.
I 10 Br
Indian Bayou
Trout Bayou
Devil Pt
Red Bluff
Northeast S.T.P.
Bohemia
KEY
SURFACE CURRENT
BOTTOM CURRENTS

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

FLOODING CURRENT DISTRIBUTION
SURFACE & BOTTOM
ESCAMBIA BAY - 9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 15


Monsanto
Simpson R.
White R.
Gulf Power
Escambia
River
U.S. Hwy. 90
East R.
Floridatown
Escambia Chemical
American Cyanamid
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1
Riverview
Mulatto
Bayou
Escambia
Lora Pt.
L&N RR Br.
I-10 Br.
Indian
Bayou
Trout
Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
KEY
SURFACE CURRENTS
BOTTOM CURRENTS

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

EBBING CURRENT DISTRIBUTION
SURFACE & BOTTOM
ESCAMBIA BAY - 9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

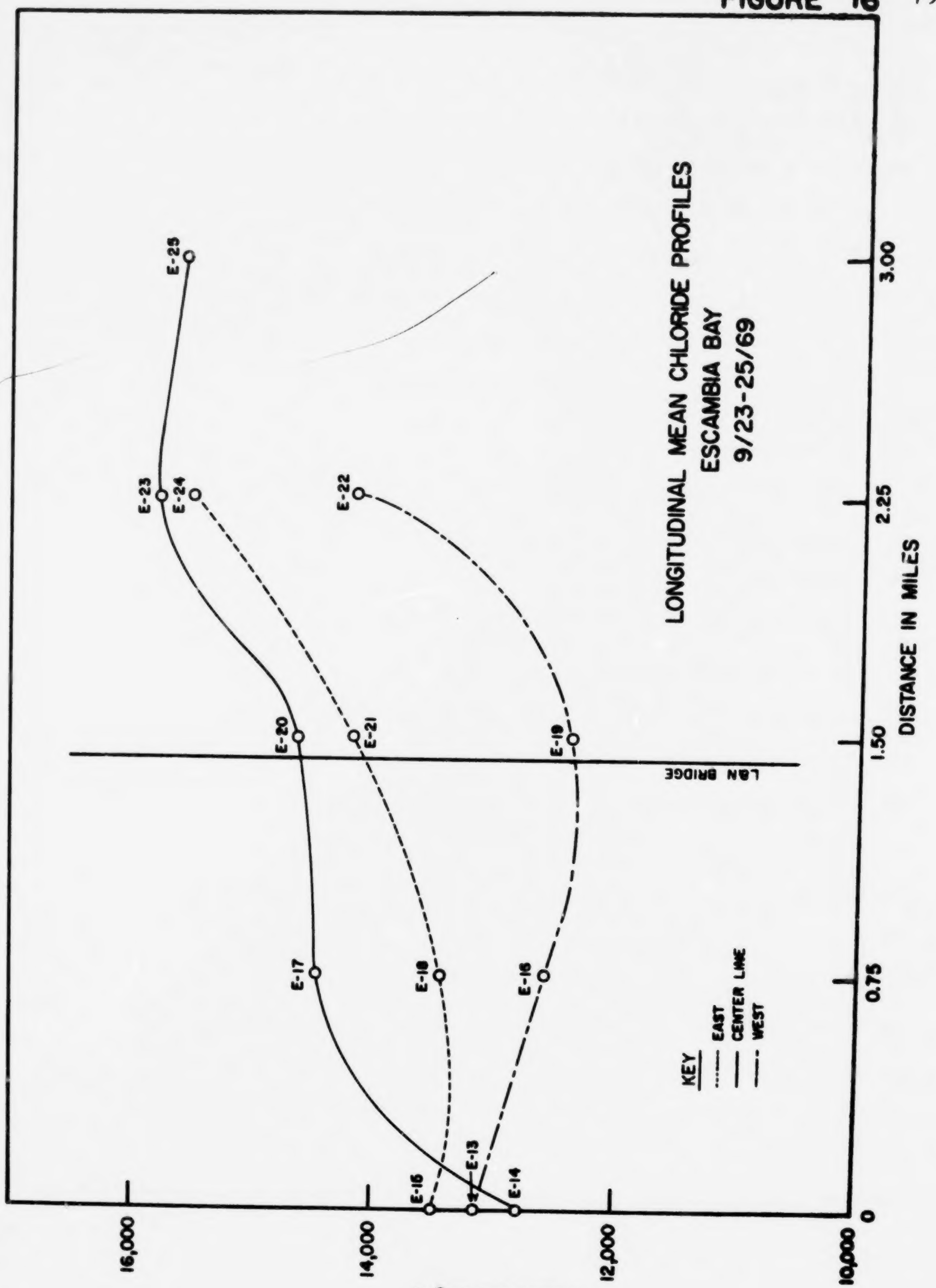
wetlands that characterize the northern part of the bay in the vicinity of the U. S. 90 bridge. This area shows little variation with tidal current indicating very poor circulation. Several fish kills have occurred in this area.

On the ebbing current, fresh water discharge from the Escambia River undergoes very little dispersion and flows south in a narrow zone on the surface, generally to the west of the center line of the bay. The more saline water recedes along the bottom of the bay primarily along the eastern shore. This impedes the flow of surface waters on the eastern shore which move in a southwesterly direction to the center and western portion of the bay.

In summary, the net outflow of water from the bay is along the western portion with intrusion of saline water on the eastern side, generally producing a counterclockwise circulation pattern. There is an area of very little flushing in the northern marsh flats above the mouth of the Escambia River.

At the point where the L & N railroad bridge crosses the bay, there is a decrease in chloride concentrations on the northwest side. This is illustrated in Figure 16. This indicates that fresh water is being held in the area just north of the bridge and is not able to discharge and disperse at a constant rate out of the bay. Escambia Bay at this location narrows to about two miles across. The area under the railroad trestle is congested due to closely spaced supporting piles, in some cases no more than three or four feet on center. These pilings occupy a significant percentage of the total cross sectional area under the trestle and reduce the volume available

FIGURE 16



LONGITUDINAL MEAN CHLORIDE PROFILES
ESCAMBIA BAY
9/23-25/69

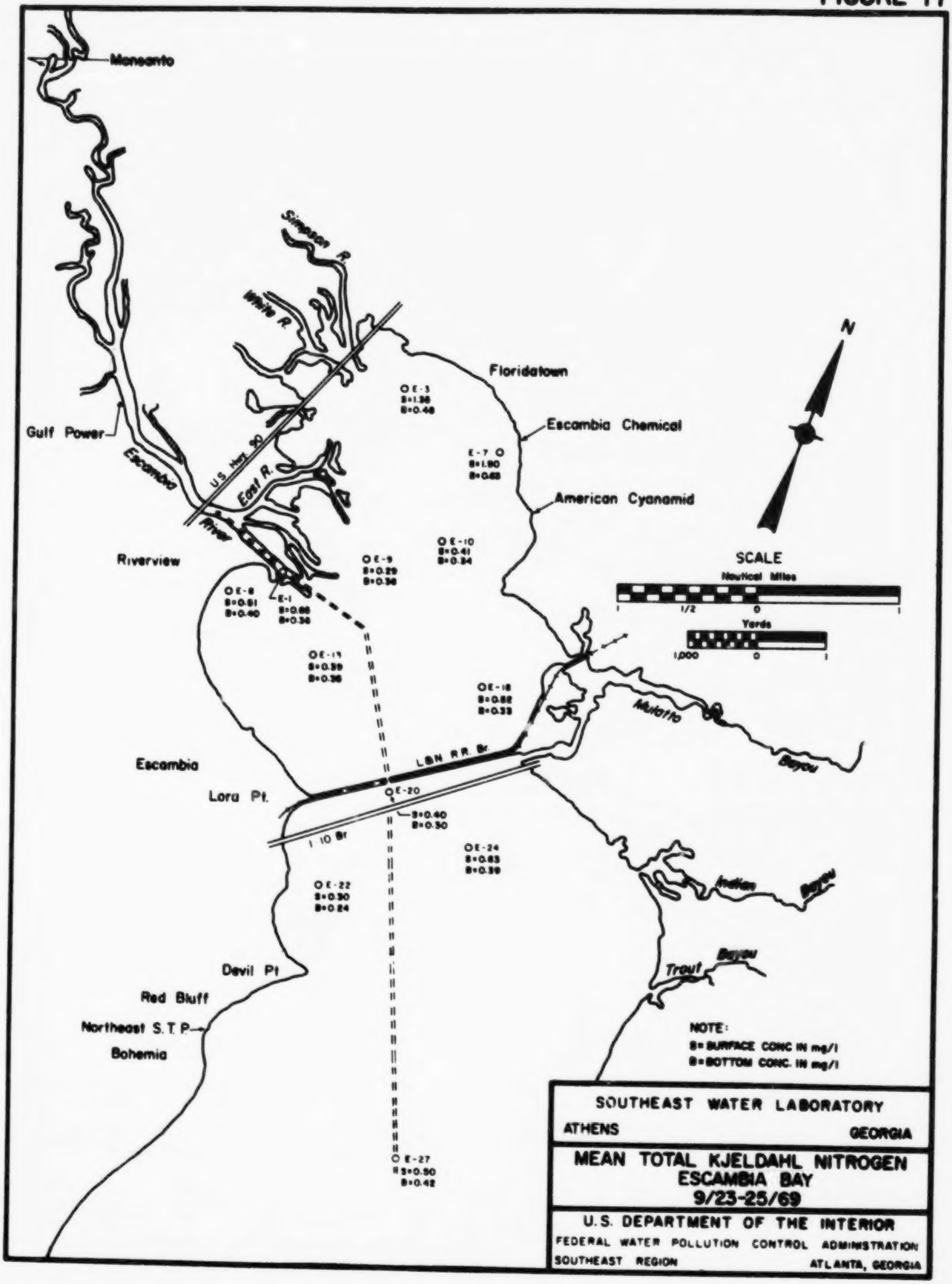
for passage of water. Therefore, any wastes discharged above the trestle will remain in this section of the bay and exercise an organic demand for a longer period of time. This includes all waste sources except the Northeast sewage treatment plant. The present L & N railroad trestle adversely affects water quality in the upper half of Escambia Bay by retarding flushing and exchange. It is recommended that this trestle be reconstructed so as to provide minimum interference with water movement in Escambia Bay.

2) Nitrogen

Figures 17, 18 and 19 show the mean distribution of total kjeldahl nitrogen, ammonia nitrogen and nitrite-nitrate nitrogen in Escambia Bay.

Nitrogen, together with carbon and phosphorus, are the major necessary ingredients in establishing a healthy ecological balance between competing species in Escambia Bay. These three constituents in organic form are stabilized by bacteria utilizing dissolved oxygen from the water. The stabilized materials, now in inorganic form, are available to the algae who produce dissolved oxygen. As algae, bacteria, and other organisms die, the carbon, nitrogen and phosphorus contained in their biomass again become sources of nutrients for succeeding generations in this cyclic process. The discharge of excessive wastes containing carbon, nitrogen and phosphorus, upsets this balance and causes a stimulation of both bacterial and algal populations. The water becomes more noticeably turbid and, as the result of respiration by the increased populations, there is a great increase in oxygen consumption resulting in a significant lowering of dissolved oxygen during the night.

FIGURE 17


Monsanto
Simpson R.
White R.
U.S. Hwy. 90
Gulf Power
Escambia
River
East R.
Floridatown
Escambia Chemical
American Cyanamid
Riverview
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1
E-3
S=1.38
B=0.48
E-7
S=1.90
B=0.63
E-10
S=0.41
B=0.34
E-9
S=0.29
B=0.36
E-8
S=0.51
B=0.40
E-1
S=0.66
B=0.36
E-19
S=0.39
B=0.36
E-18
S=0.62
B=0.33
Mulatto
Bayou
Escambia
Lora Pt.
L&N R.R. Br.
E-20
S=0.40
B=0.30
I 10 Br.
E-24
S=0.63
B=0.39
E-22
S=0.30
B=0.24
Indian
Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
Trout
Bayou
E-27
S=0.50
B=0.42

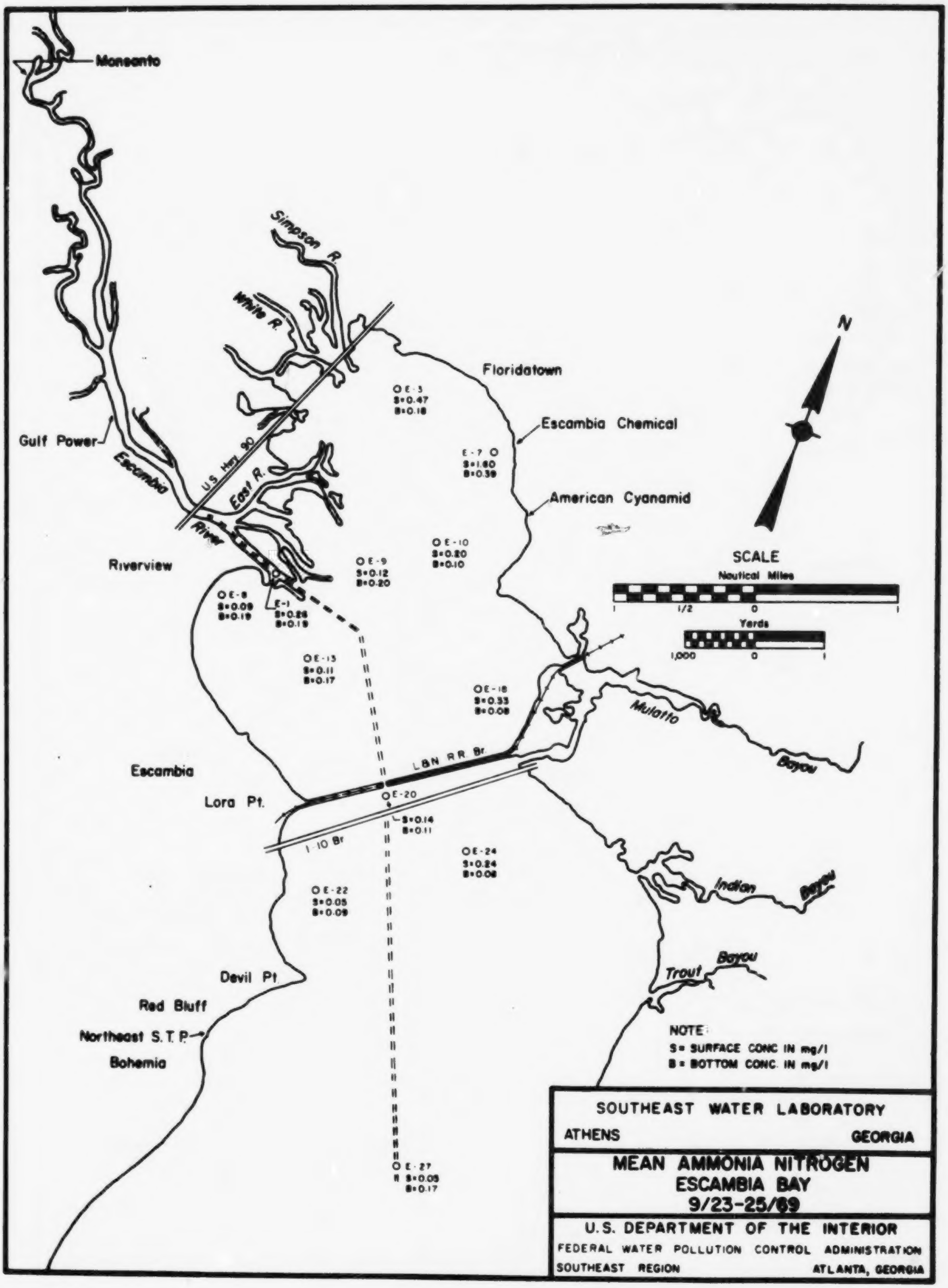
NOTE:
S= SURFACE CONC IN mg/l
B= BOTTOM CONC. IN mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN TOTAL KJELDAHL NITROGEN
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 18


Monsanto
Simpson R.
White R.
Floridatown
Gulf Power
Escambia River
U.S. Hwy. 90
East R.
Escambia Chemical
American Cyanamid
N
E-3 S=0.47 B=0.18
E-7 S=1.60 B=0.39
E-10 S=0.20 B=0.10
E-9 S=0.12 B=0.20
Riverview
E-8 S=0.09 B=0.19
E-1 S=0.26 B=0.19
E-13 S=0.11 B=0.17
E-18 S=0.33 B=0.08
SCALE
Nautical Miles
1 1/2 0 1
Yards
1,000 0 1
Mulatto Bayou
L&N RR Br.
Escambia
Lora Pt.
E-20 S=0.14 B=0.11
I-10 Br.
E-24 S=0.24 B=0.08
E-22 S=0.05 B=0.09
Indian Bayou
Trout Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
E-27 S=0.05 B=0.17

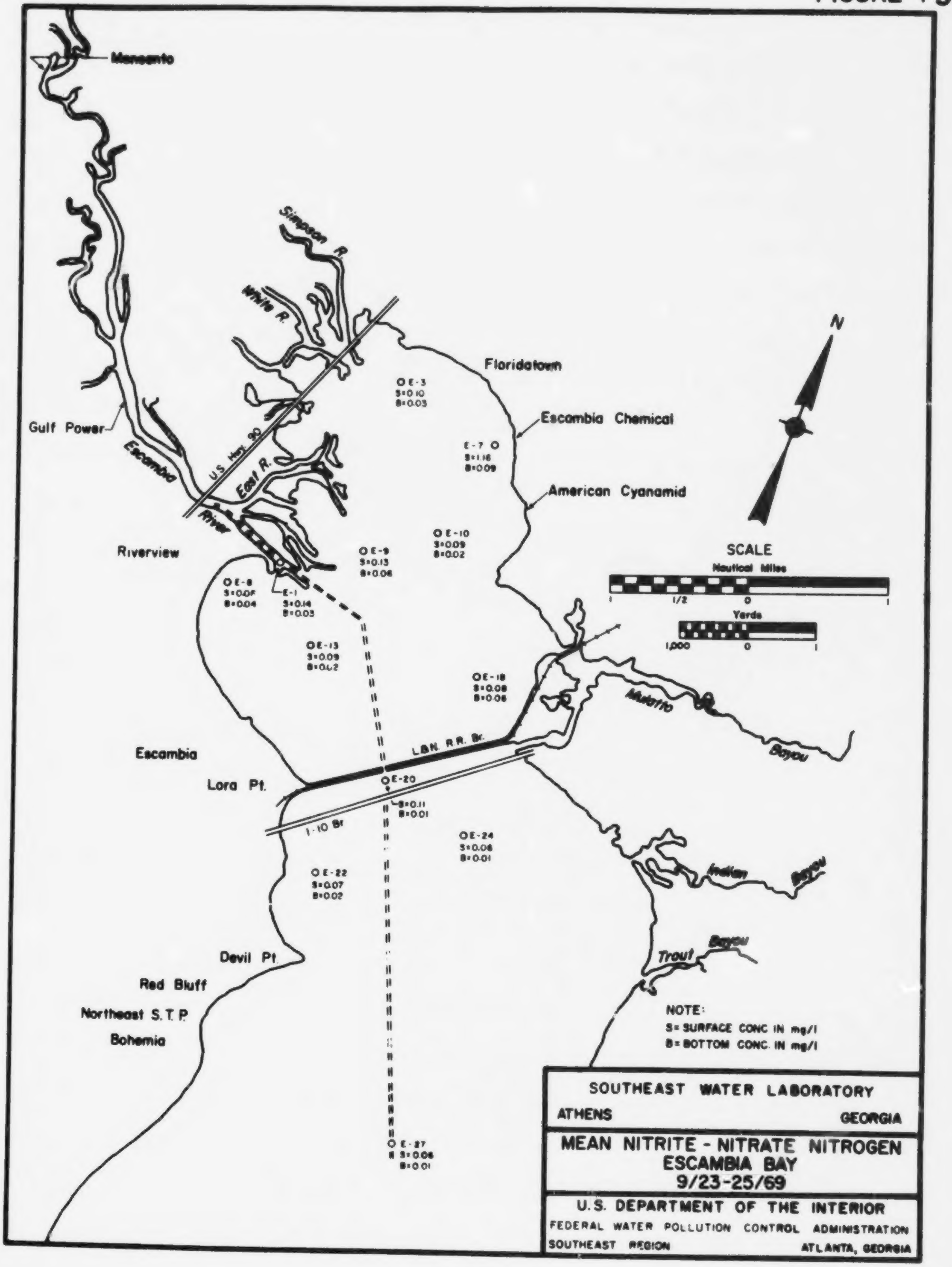
NOTE:
S= SURFACE CONC IN mg/l
B= BOTTOM CONC. IN mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN AMMONIA NITROGEN
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 19


Monsanto
Simpson R.
White R.
Floridatown
Gulf Power
Escambia River
U.S. Hwy. 90
East R.
Escambia Chemical
American Cyanamid
Riverview
O E-3
S=0.10
B=0.03
E-7 O
S=1.16
B=0.09
O E-10
S=0.09
B=0.02
O E-9
S=0.13
B=0.06
O E-8
S=0.05
B=0.04
E-1
S=0.14
B=0.03
O E-13
S=0.09
B=0.02
O E-18
S=0.08
B=0.06
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1
Mulatto Bayou
L&N. R.R. Br.
Escambia
Lora Pt.
O E-20
S=0.11
B=0.01
I-10 Br
O E-24
S=0.06
B=0.01
O E-22
S=0.07
B=0.02
Indian Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
Trout Bayou
O E-27
S=0.06
B=0.01

NOTE:
S= SURFACE CONC. IN mg/l
B= BOTTOM CONC. IN mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN NITRITE - NITRATE NITROGEN
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

Oxygen dependent higher organisms, such as fish, may be stressed to the point where they no longer can survive.

The maximum concentrations of total kjeldahl nitrogen are in the northeast section of the Bay in the vicinity of the Escambia Chemical and American Cyanamid outfalls. These surface values are approximately three to four times greater than other parts of Escambia Bay exhibiting a maximum mean value of 1.90 mg/l near the Escambia Chemical discharge. Concentrations of TKN one foot above the bottom of the bay were relatively constant between 0.3 mg/l and 0.4 mg/l throughout the bay except the northeast section where values about one and one-half times greater were observed. The maximum mean bottom value was 0.63 mg/l, again occurring off the Escambia Chemical outfall. Higher than average surface concentrations of TKN were also observed along the eastern shore of the Bay near Mulatto Bayou.

Ammonia nitrogen exhibited the same distribution pattern as TKN with most of Escambia Bay showing concentrations between 0.1 mg/l and 0.2 mg/l except for the northeast section and, to a lesser extent, the eastern portion. The maximum mean surface concentration of 1.60 mg/l was as much as 32 times greater than the western and central sections of the bay. Bottom concentrations in the northeast part were about four times less than surface values, but were still two to three times greater than bottom concentrations in other sections.

Nitrite-nitrate nitrogen was at a maximum in the northeast section where it was more than ten times greater than the rest of the bay at a surface mean concentration of 1.16 mg/l. Bottom concentrations were all less than 0.1 mg/l

The northeast section of Escambia Bay is excessively over-enriched with nitrogen as the result of the discharges from Escambia Chemical and American Cyanamid. Escambia Chemical, since it discharges the largest quantities of both ammonia nitrogen and nitrite nitrate nitrogen is the more damaging waste. Monsanto Company also discharges a significant quantity of nitrogenous waste, and contributes, in a lesser degree since it is further removed, to the excessive concentrations in the extreme northeast and eastern section of the Escambia Bay. Evaluation of current movement showed that water from the Escambia River flows toward the eastern section of the bay during the flooding phase.

Nitrogen concentrations in Escambia Bay are listed in Table 5.

3) Phosphorus

Only very minute quantities of phosphorus are sufficient in maintaining a healthy biological balance. It is a required nutrient and artificial inputs are amenable to control and abatement. Its availability in excessive concentrations has been connected with large algae populations. Ortho-phosphate is the form most readily available to algae. Figures 20 and 21 illustrate the total and ortho-phosphate distribution in Escambia Bay.

Total phosphate 9/ concentrations at the surface of Escambia Bay were highest in the northeast section and in the southwest south of the L & N railroad trestle. The maximum mean concentration observed was 0.292 mg/l offshore of the Escambia Chemical discharge.

9/ All phosphate values reported as phosphorus (P)

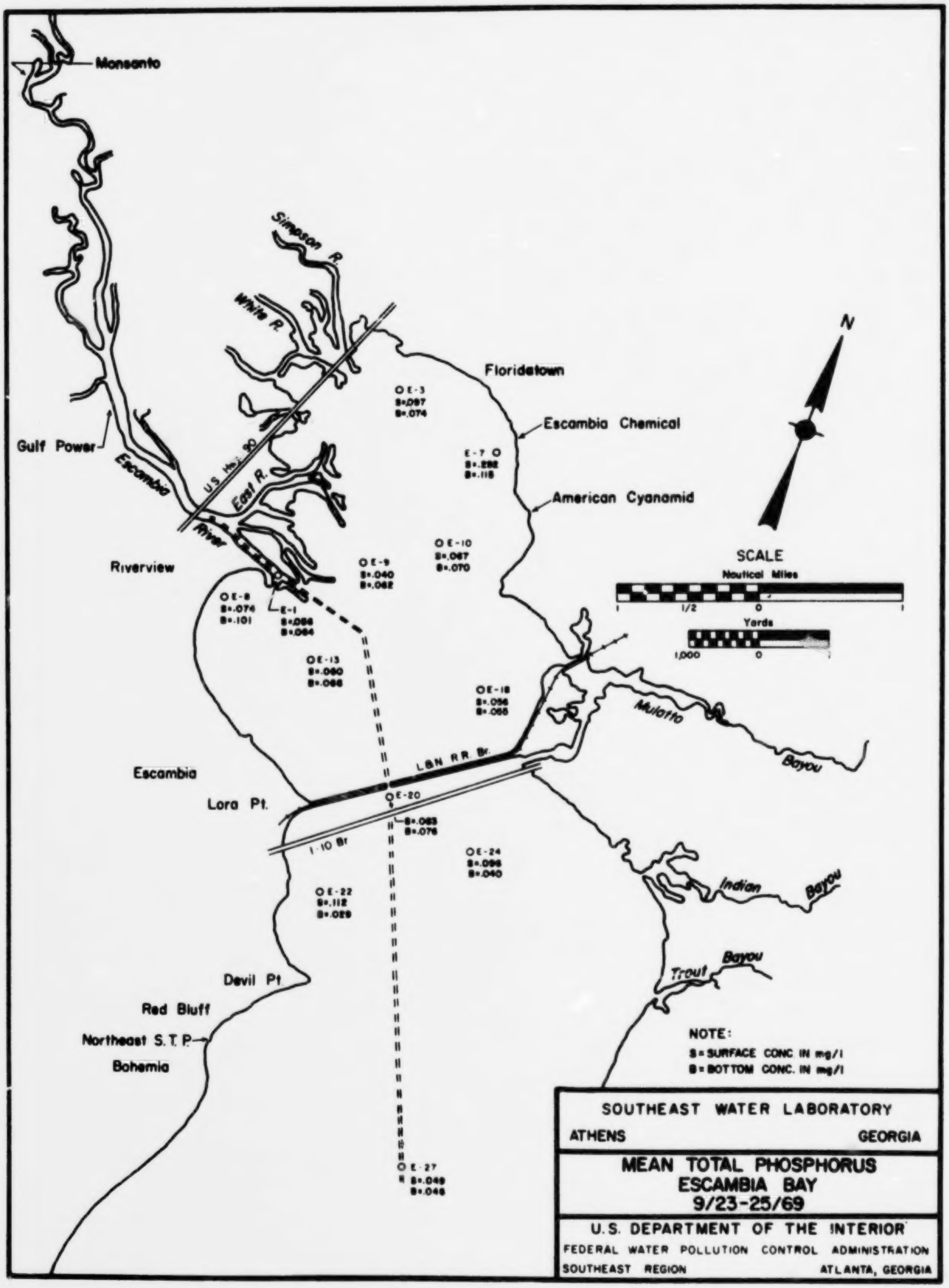
TABLE 5

MEAN NITROGEN CONCENTRATIONS - ESCAMBIA BAY

September 23-25, 1969

Station Location	Total Kjeldahl Nitrogen		Ammonia Nitrogen		Nitrite-Nitrate Nitrogen	
	Surface	Bottom	Surface	Bottom	Surface	Bottom
	mg/l		mg/l		mg/l	
E-1	0.65	0.36	0.26	0.19	0.14	0.03
E-3	1.35	0.48	0.47	0.18	0.10	0.03
E-7	1.90	0.63	1.60	0.39	1.16	0.09
E-8	0.51	0.40	0.09	0.19	0.06	0.04
E-9	0.29	0.36	0.12	0.12	0.13	0.06
E-10	0.41	0.34	0.20	0.10	0.09	0.02
E-13	0.39	0.35	0.11	0.17	0.09	0.02
E-18	0.52	0.33	0.33	0.08	0.08	0.06
E-20	0.40	0.30	0.14	0.11	0.11	0.01
E-22	0.30	0.24	0.05	0.09	0.07	0.02
E-24	0.63	0.34	0.24	0.08	0.06	0.01
E-27	0.50	0.42	0.05	0.17	0.06	0.01

FIGURE 20


Monsanto
Simpson R.
White R.
Floridatown
Escambia Chemical
American Cyanamid
Gulf Power
Escambia
River
U.S. Hy. 90
East R.
Riverview
O E-3
S=.097
B=.074
E-7 O
S=.282
B=.118
O E-10
S=.067
B=.070
O E-9
S=.040
B=.062
O E-8
S=.074
B=.101
E-1
S=.086
B=.064
O E-13
S=.060
B=.066
O E-18
S=.056
B=.065
Mulatto
Bayou
Escambia
Lora Pt.
L&N R.R. Br.
O E-20
S=.063
B=.076
I-10 Br.
O E-24
S=.096
B=.040
O E-22
S=.112
B=.029
Indian
Bayou
Trout
Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
O E-27
S=.049
B=.046
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0

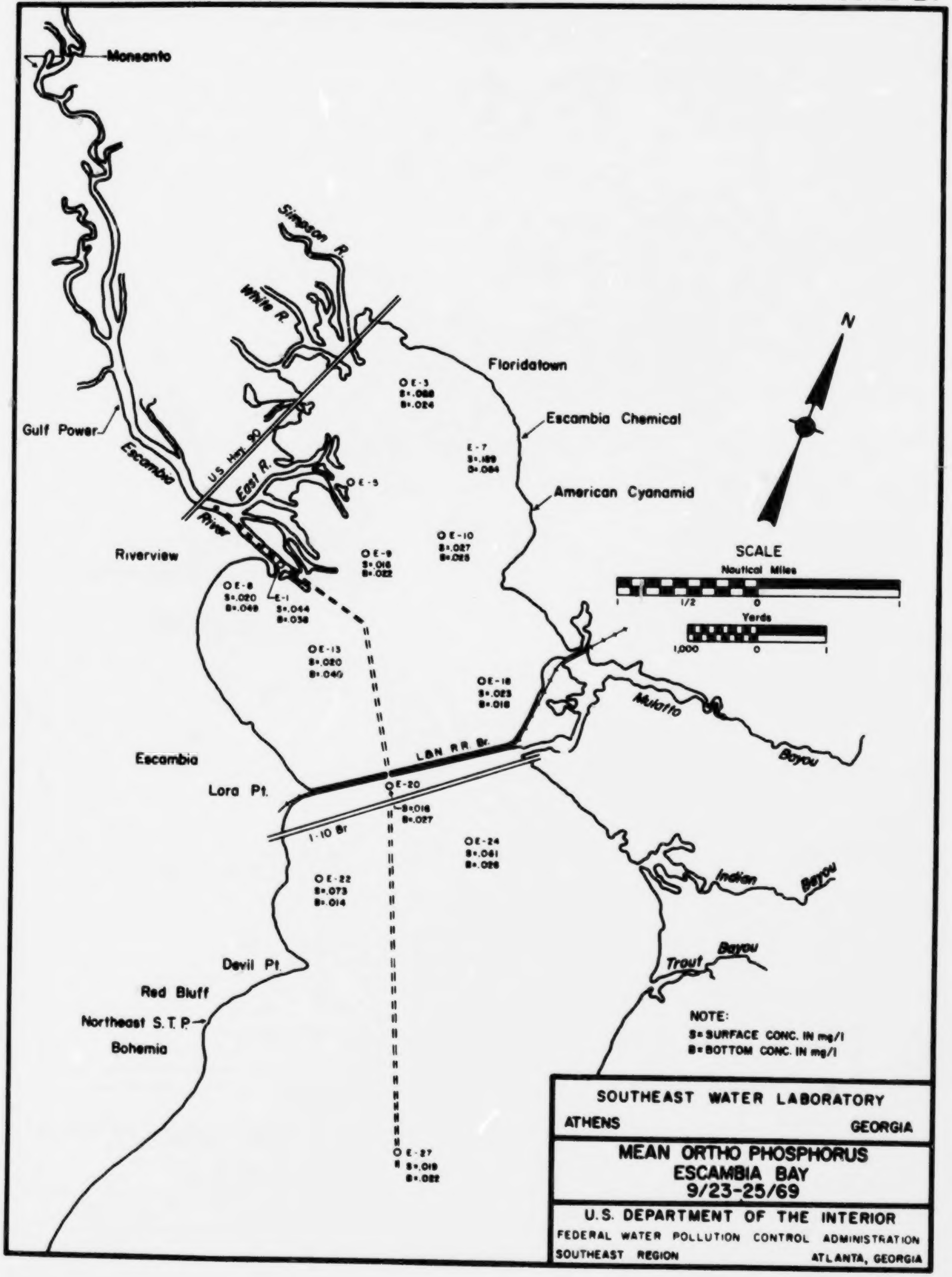
NOTE:
S = SURFACE CONC. IN mg/l
B = BOTTOM CONC. IN mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN TOTAL PHOSPHORUS
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 21


Monsanto
Simpson R.
White R.
U.S. Hwy. 90
Floridatown
O E-3
S=.068
B=.024
Escambia Chemical
Gulf Power
Escambia River
East R.
E-7
S=.189
D=.084
O E-5
American Cyanamid
O E-10
S=.027
B=.025
O E-9
S=.016
B=.022
Riverview
O E-8
S=.020
B=.049
E-1
S=.044
B=.038
O E-13
S=.020
B=.040
O E-18
S=.023
B=.018
N
SCALE
Nautical Miles
1/2
0
1
Yards
1,000
0
1
Mulatto Bayou
L&N R.R. Br.
Escambia
Lora Pt.
O E-20
S=.018
B=.027
I-10 Br
O E-24
S=.061
B=.026
O E-22
S=.073
B=.014
Indian Bayou
Devil Pt.
Trout Bayou
Red Bluff
Northeast S.T.P.
Bohemia
O E-27
S=.019
B=.022

NOTE:
S=SURFACE CONC. IN mg/l
B=BOTTOM CONC. IN mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN ORTHO PHOSPHORUS
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

The second highest surface concentration of 0.112 mg/l was observed just north of the effluent discharge from the City of Pensacola's Northeast sewage treatment plant. Concentrations in the area immediately south of the L & N bridge were generally higher than the central and western part of the bay north of the bridge. Concentrations, both on the surface and bottom were slightly higher on the western side than the central section. The bottom distribution of total phosphate was also higher in the northeast section showing a maximum value of 0.115 mg/l offshore of Escambia Chemical. However, concentrations south of the L & N bridge were generally lower than those north of the bridge except in the ship channel immediately south of the bridge.

Ortho-phosphate concentrations exhibited the same distribution as total phosphate with the maximum concentrations of 0.189 mg/l and 0.064 mg/l for surface and bottom respectively, being observed offshore of Escambia Chemical. The second highest surface concentration of 0.073 mg/l was north of the outfall from the Northeast sewage treatment plant. Ortho-phosphate concentrations on the bottom were generally higher north of the L & N bridge than south.

The major waste effluent affecting phosphate concentrations in the northeast section of Escambia Bay is Escambia Chemical Company, the largest discharger of ortho-phosphate of all waste sources. The source of the high surface total and ortho-phosphate in the southwest part of the bay is the Northeast sewage treatment plant effluent. The concentrations of phosphate on the western side of the bay above the L & N bridge are affected by the effluent from the Monsanto Company and, to a much lesser extent, from Container Corporation.

On the ebbing current, effluent from Monsanto flows out of the Escambia River and south along the western side of the Bay. Monsanto discharges 38.1% of the total phosphate and 34.7% of the ortho-phosphate from all waste sources. Container Corporation discharges 13.6% of the total phosphate and 9.6% of the ortho-phosphate.

Phosphate concentrations in Escambia Bay are listed in Table 6.

4) Dissolved Oxygen

The mean surface dissolved oxygen concentrations in Escambia Bay is shown in Figure 22. This figure is shown as lines of equal concentration (isolines) to demonstrate dissolved oxygen variation throughout the bay. There are four factors which may directly affect DO in Escambia Bay: stabilization of soluble or suspended oxygen demanding materials; stabilization of bottom deposits containing high organic content; photosynthesis and respiration by algae; and reaeration. Soluble and suspended oxygen demanding materials may be characterized using theoretical oxygen demand (TOD) concentrations. Benthic demand may be evaluated from a consideration of organic carbon content of bottom deposits. Phytoplankton concentrations, as well as variation in dissolved oxygen at a point with time, are indicators of photosynthetic effects. Reaeration has a minor effect on DO in Escambia Bay relative to the other three phenomena. Flushing and exchange of water out of Escambia Bay is also limited with respect to the upper section of the bay.

Mean concentrations of DO at the surface of Escambia Bay were all greater than 4.0 mg/l, the official Florida criterion. The lowest mean concentrations were observed in the northern section near the marsh flats.

TABLE 6

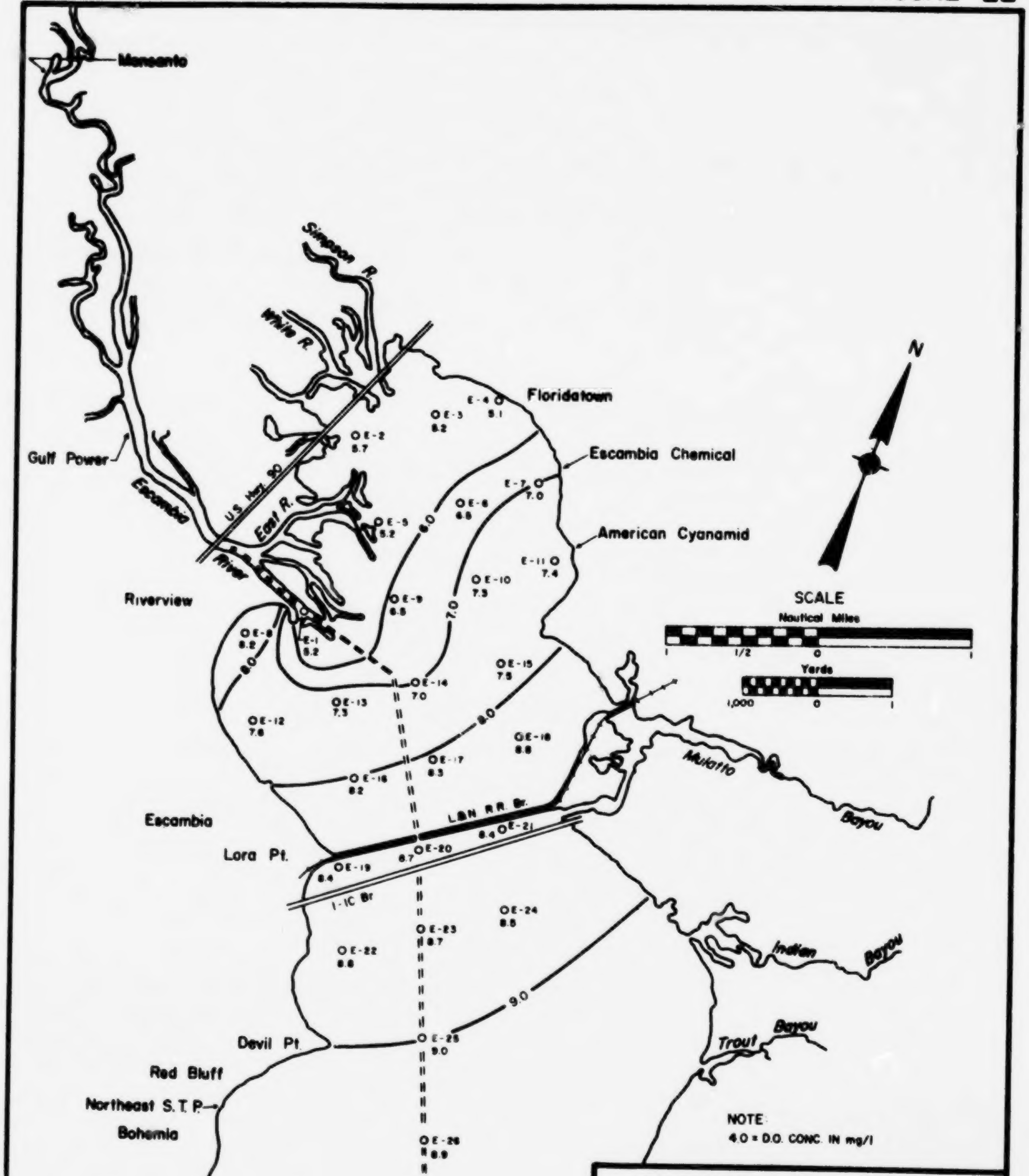
MEAN PHOSPHATE CONCENTRATIONS - ESCAMBIA BAY

September 23-25, 1969

Station Location	Total Phosphate*		Ortho-Phosphate as Phosphorus	
	Surface	Bottom	Surface	Bottom
	mg/l		mg/l	
E-1	.056	.064	.044	.038
E-3	.097	.074	.028	.024
E-7	.292	.115	.189	.064
E-8	.074	.101	.020	.049
E-9	.040	.062	.016	.022
E-10	.067	.070	.027	.025
E-13	.060	.066	.020	.040
E-18	.056	.055	.023	.018
E-20	.083	.076	.016	.027
E-22	.112	.029	.073	.014
E-24	.096	.040	.041	.026
E-27	.049	.046	.019	.022

* As P

FIGURE 22


Monsanto
Simpson R.
White R.
U.S. Hwy. 90
Gulf Power
Escambia
East R.
River
Riverview
Floridatown
Escambia Chemical
American Cyanamid
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1
E-1 5.2
E-2 5.7
E-3 6.2
E-4 5.1
E-5 5.2
E-6 6.5
E-7 7.0
E-8 6.2
E-9 6.5
E-10 7.3
E-11 7.4
E-12 7.6
E-13 7.3
E-14 7.0
E-15 7.5
E-16 8.2
E-17 8.3
E-18 8.8
E-19 8.4
E-20 8.7
E-21 8.4
E-22 8.8
E-23 8.7
E-24 8.5
E-25 9.0
E-26 8.9
E-27 9.8
E-28 8.7
6.0
7.0
8.0
8.0
9.0
Mulatto
Bayou
L&N RR. Br.
I-IC Br.
Escambia
Lora Pt.
Indian
Bayou
Trout
Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
NOTE:
4.0 = D.O. CONC. IN mg/l

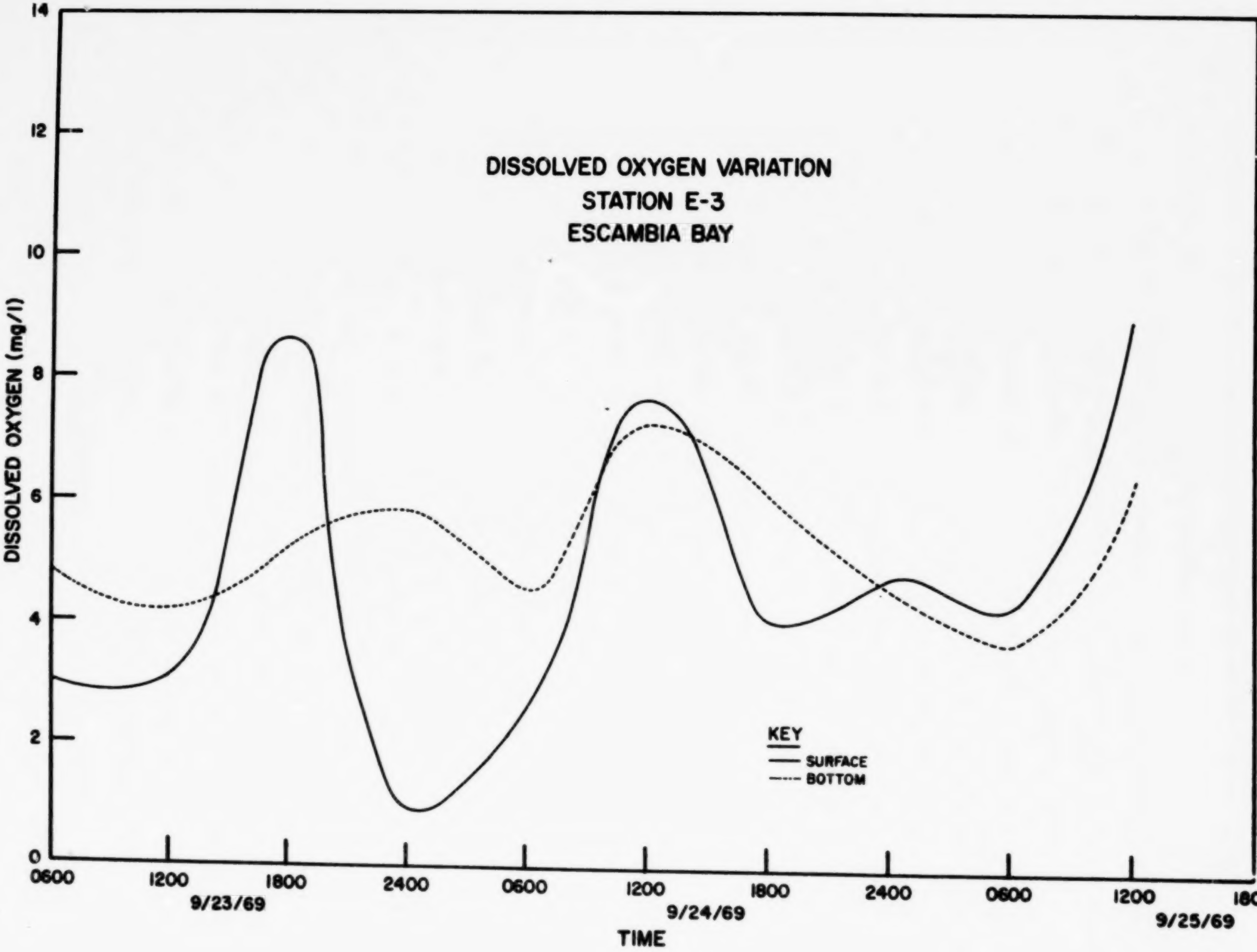
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN SURFACE DISSOLVED OXYGEN
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

These concentrations were greater than 5.0 mg/l. Surface concentrations in the central and southern portions of the bay were generally between 7.0 and 9.0 mg/l. However, there is a great amount of variation in almost all of the locations sampled north of the L & N railroad bridge. Figure 23 shows this variation for sampling location E-3 in the extreme northern Bay. The maximum surface concentration observed was 8.3 mg/l while the minimum was 1.0 mg/l. Forty percent of the samples were less than 4.0 mg/l. The higher concentrations invariably occur during daylight and the lower values are observed at night. This is a classical DO distribution caused by variation in algal photosynthesis. The bay is relatively shallow and has poor circulation in this section. It also is the section of the bay containing the highest nutrient concentrations. All of these factors are conducive to increased algal activity and production. Because phytoplankton activity, dissolved oxygen concentrations on the surface in the northern section of the bay frequently are less than 4.0 mg/l and could conceivably be completely absent with the warmer water temperatures which occur during July and August. These variations are partially responsible for the fish kills occurring in the northern section of the bay. Fish may swim into the area during the day when DO is high, since the marshes are a natural source of food supply, and become trapped when there is a rapid decline after sunset. The major stimulants to excessive planktonic photosynthesis and respiration in the northern section of the bay are the excessive quantities of carbon and nitrogen discharged by the American Cyanamid Company, and of nitrogen and phosphate discharged by Escambia Chemical Company.

FIGURE 23

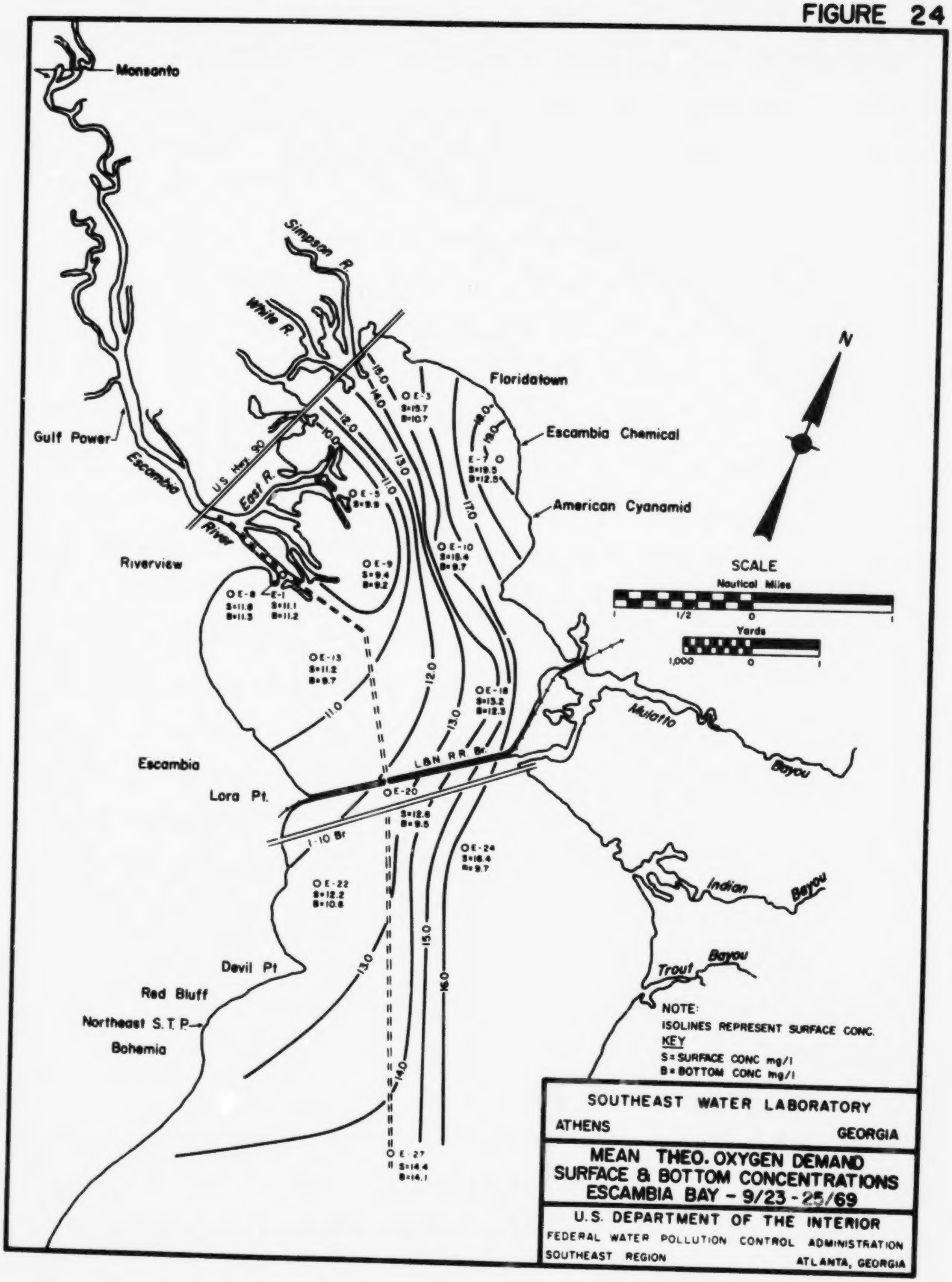

DISSOLVED OXYGEN VARIATION
STATION E-3
ESCAMBIA BAY
DISSOLVED OXYGEN (mg/l)
14
12
10
8
6
4
2
0
0600
1200
1800
2400
0600
1200
1800
2400
0600
1200
1800
9/23/69
9/24/69
9/25/69
TIME
KEY
SURFACE
BOTTOM

The effect of these wastes is demonstrated by consideration of the mean TOD distribution shown in Figure 24. The highest surface concentrations are in the vicinity of these outfalls and are almost twice as high as the remainder of the bay. Bottom concentrations are also higher. These concentrations show the potential oxygen demand from unstabilized soluble or suspended organic material. In addition to respiration by algae, dissolved oxygen can be reduced directly through stabilization of this pollution.

Photosynthesis and respiration by algae are apparent in all areas of the bay north of the L & N railroad bridge. Figure 25 shows the DO variation at sampling location E-9 in the central part of the upper bay. The range was from 5.0 mg/l to 11.8 mg/l. Although none of the surface observations were less than 4.0 mg/l, this range of 6.8 mg/l is indicative of a highly enriched environment. Figure 26 is representative of DO variation in the eastern section of the upper bay. The surface range at this location (E-18) is also 6.8 mg/l. Variation in the lower bay is significantly less reflecting the improved flushing and exchange as well as the generally lower concentration of nutrient material. At location E-27 (Figure 27), if the initial observation is excluded, the surface range is about 3.5 mg/l with a mean of 8.7 mg/l. There is very little variation in the bottom DO.

Although phytoplankton populations are not, of themselves, directly correlated with activity manifested through photosynthesis and respiration, they do illustrate imbalances in numbers within the system. On one of the sampling excursions, phytoplankton samples were collected from the surface on an ebbing current during daylight hours.

FIGURE 24


Monsanto
Simpson R.
White R.
Gulf Power
Escambia River
U.S. Hwy. 90
East R.
Floridatown
Escambia Chemical
American Cyanamid
Riverview
N
SCALE
Nautical Miles
1 1/2 0 1
Yards
1,000 0 1
15.0
14.0
12.0
10.0
11.0
13.0
17.0
18.0
19.0
E-3 S=15.7 B=10.7
E-7 S=19.5 B=12.5
E-5 S=9.9
E-10 S=15.4 B=9.7
E-9 S=9.4 B=9.2
E-8 S=11.8 B=11.3
E-1 S=11.1 B=11.2
E-13 S=11.2 B=9.7
E-18 S=13.2 B=12.3
E-20 S=12.8 B=9.5
E-24 S=16.4 B=9.7
E-22 S=12.2 B=10.6
E-27 S=14.4 B=14.1
Mulatto Bayou
Escambia
Lora Pt.
L&N RR. Br.
I-10 Br
Indian Bayou
Trout Bayou
Devil Pt
Red Bluff
Northeast S.T.P.
Bohemia
16.0

NOTE:
ISOLINES REPRESENT SURFACE CONC.

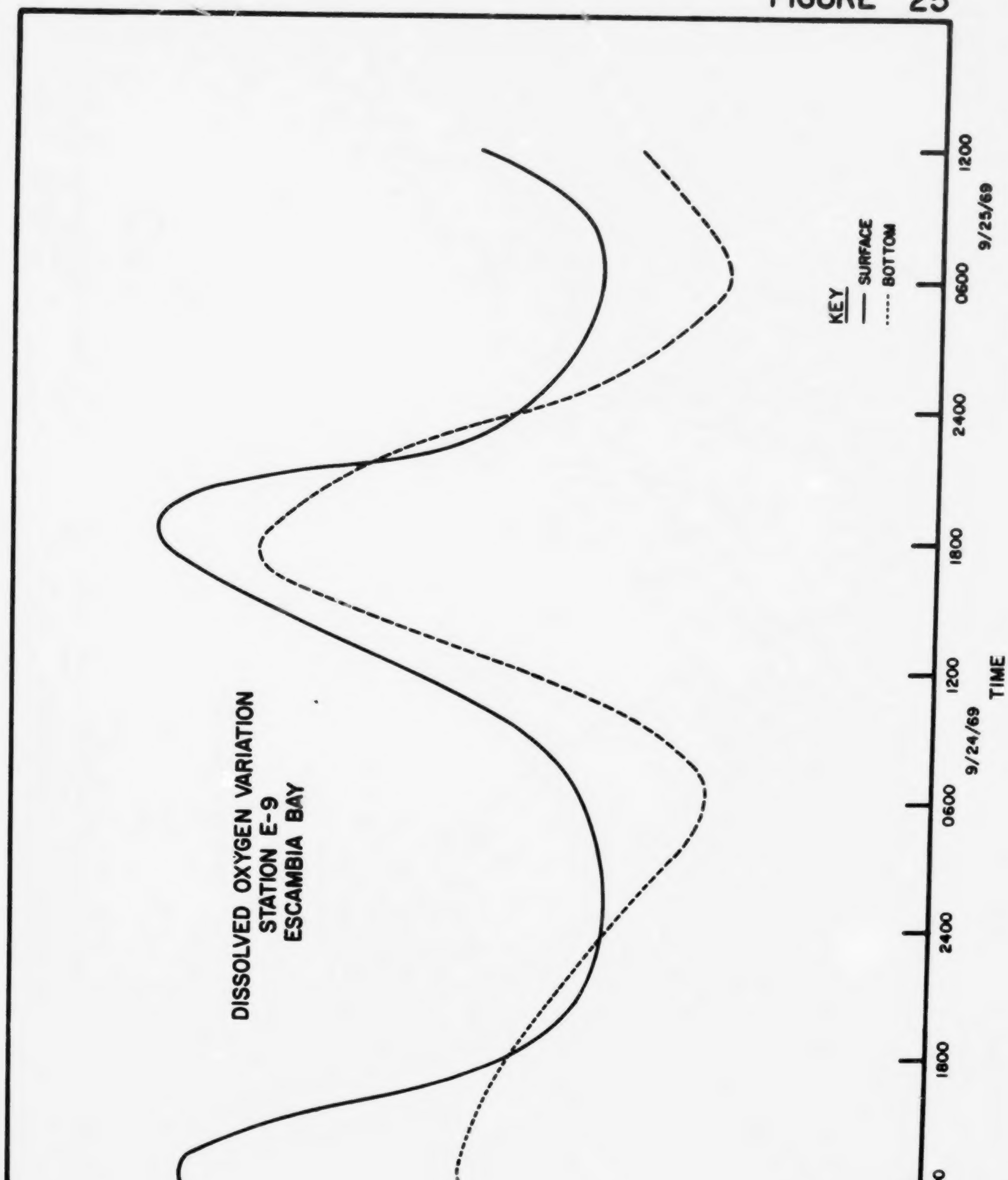
KEY
S = SURFACE CONC mg/l
B = BOTTOM CONC mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

MEAN THEO. OXYGEN DEMAND
SURFACE & BOTTOM CONCENTRATIONS
ESCAMBIA BAY - 9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 25


DISSOLVED OXYGEN VARIATION
STATION E-9
ESCAMBIA BAY
KEY
— SURFACE
----- BOTTOM
DISSOLVED OXYGEN (mg/l)
0
2
4
6
8
10
12
0600
1200
1800
2400
0600
1200
1800
2400
0600
1200
9/23/69
9/24/69
9/25/69
TIME

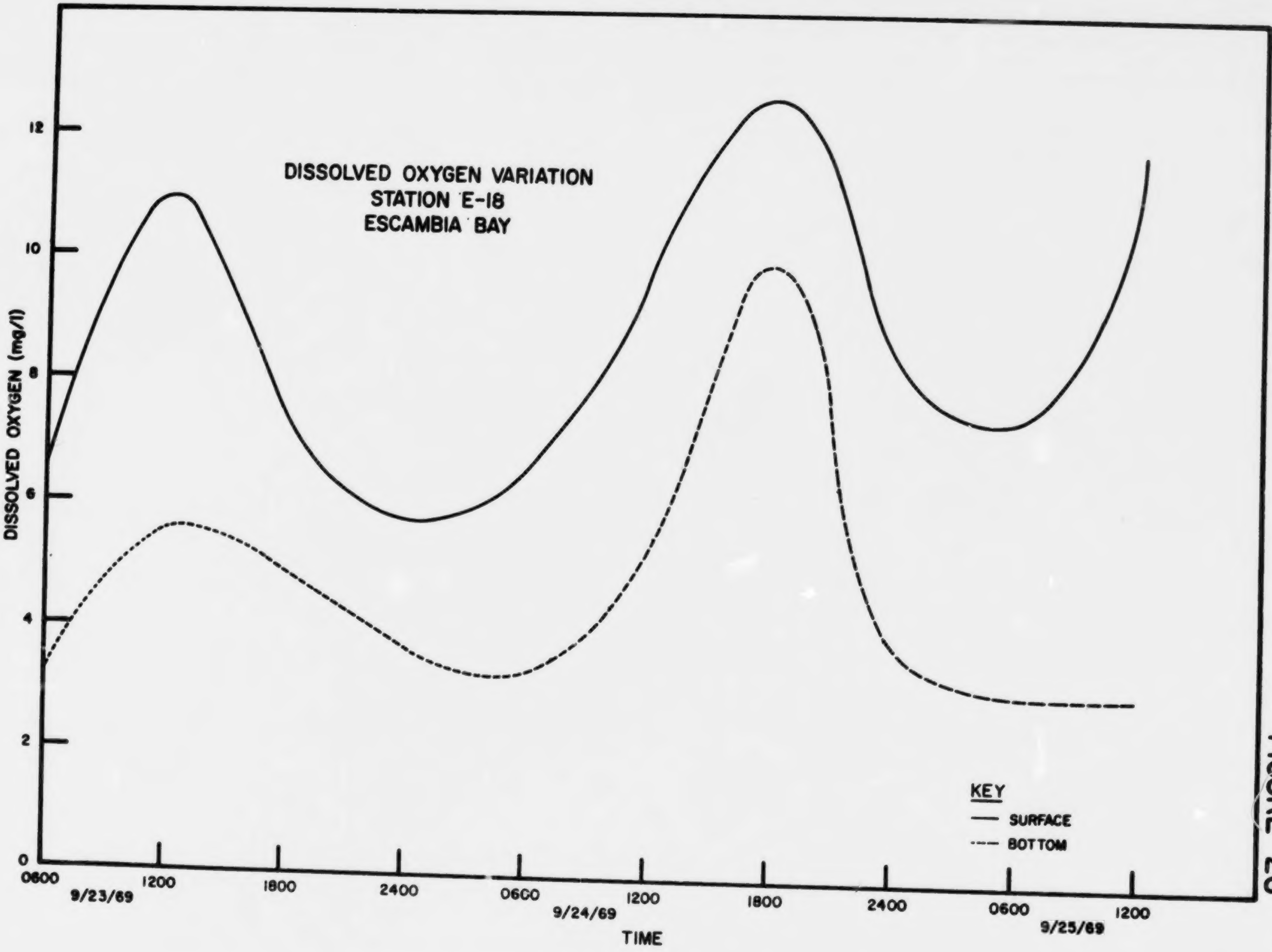
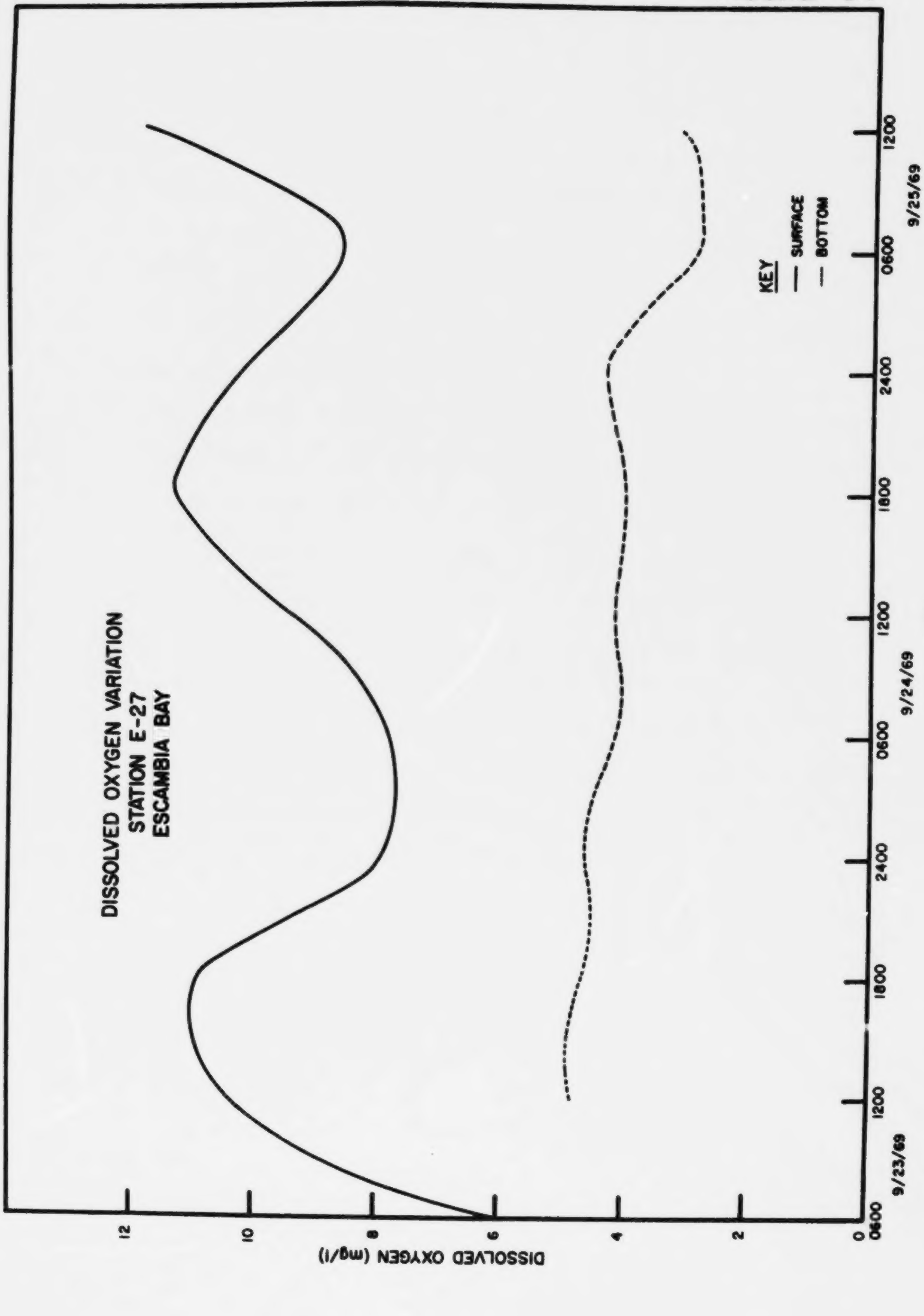

DISSOLVED OXYGEN VARIATION
STATION E-18
ESCAMBIA BAY
DISSOLVED OXYGEN (mg/l)
0
2
4
6
8
10
12
0600
9/23/69
1200
1800
2400
0600
9/24/69
1200
1800
2400
0600
9/25/69
1200
TIME
KEY
— SURFACE
--- BOTTOM

FIGURE 26

FIGURE 27



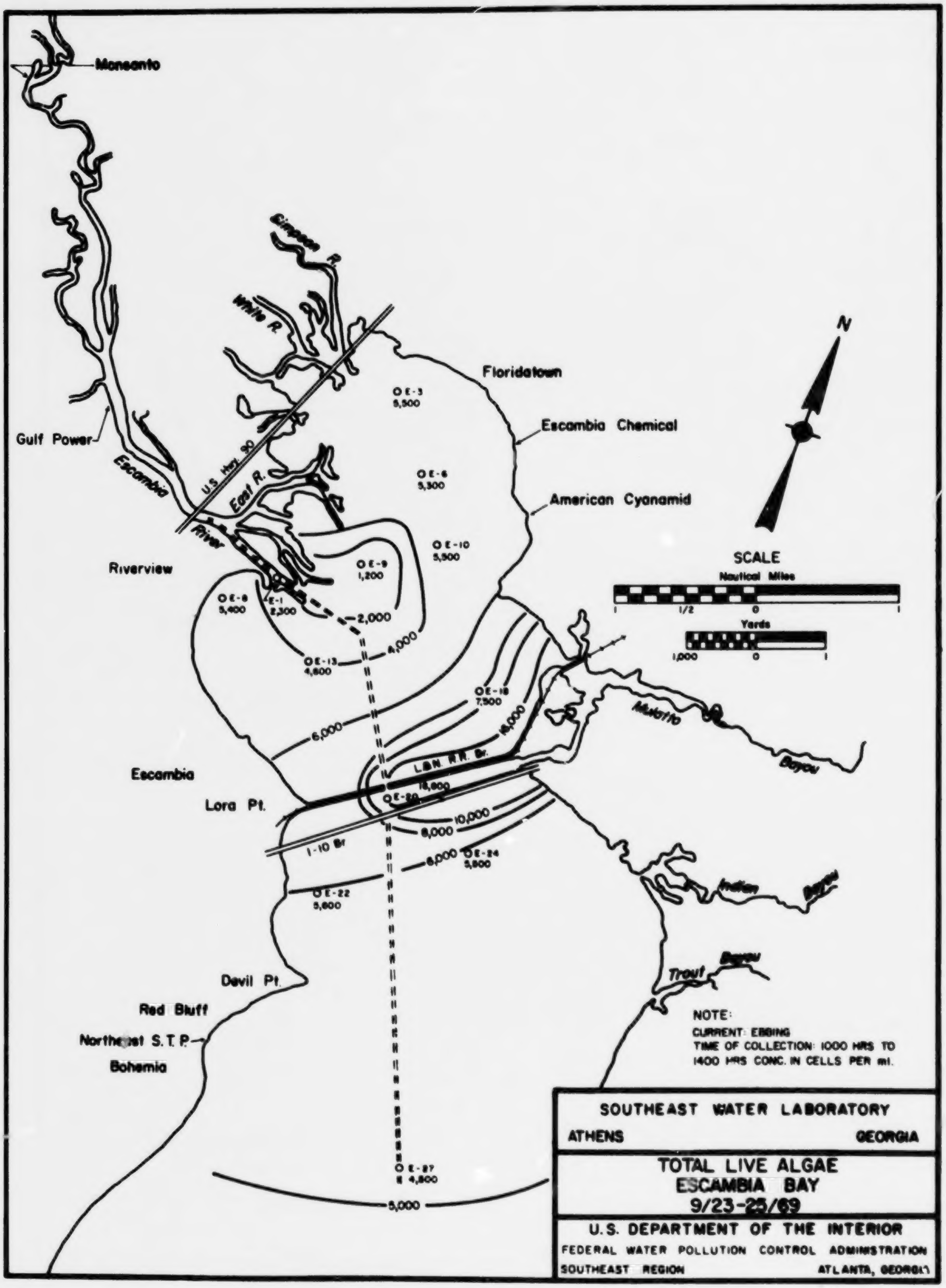
DISSOLVED OXYGEN VARIATION
STATION E-27
ESCAMBIA BAY

Figure 28 shows the phytoplankton distribution at this time. The population in most of the bay is relatively constant between 5,000 and 6,000 cells per ml. Most of these phytoplankton grow in the bay, as the bay concentrations are two to three times greater than in the Escambia River. However, in the vicinity of the southern entrance to Mulatto Bayou, the populations rapidly increase to about three times the concentration in the rest of Escambia Bay. The source of these phytoplankton populations is Mulatto Bayou. It is also the major source of the high nitrogen and phosphorus concentrations observed on the eastern side of the bay below the L & N bridge. On the ebbing current, Mulatto Bayou is a contributor of nutrient and oxygen demanding materials to Escambia Bay.

Figures 23, 25, 26, and 27 show that there is a significantly lesser concentration of dissolved oxygen near the bottom of Escambia Bay compared to the surface. Figure 29 illustrates only the 4.0 mg/l isoline for the mean value of bottom DO. The entire volume of the deeper water within this isoline had dissolved oxygen concentrations of less than 4.0 mg/l. This represents about 43% of the area of the bay and includes all of the central and northern section of the bay except for the marsh flats section in the north. Above the L & N railroad bridge the percentage of the bay less than 4.0 mg/l is about 60%. Two of the sampling locations within this area had mean DO concentrations of slightly greater than 4.0 mg/l but these means are strongly influenced by a few anomalously high individual values.

The oxygen demand of benthic deposits is the major factor affecting DO in the bottom water. To a lesser extent, the TOD also causes lower oxygen concentrations.

FIGURE 28


Monsanto
Simpson R.
White R.
Gulf Power
Escambia River
U.S. Hwy. 90
East R.
Floridatown
Escambia Chemical
American Cyanamid
Riverview
N
SCALE
Nautical Miles
1 1/2 0 1
Yards
1,000 0 1
E-3 5,500
E-6 5,300
E-10 5,500
E-9 1,200
E-8 3,400
E-1 2,300
2,000
4,000
E-13 4,600
E-18 7,500
6,000
14,000
Mulatto Bayou
L&N. R.R. Br.
16,000
E-20
Escambia
Lora Pt.
10,000
8,000
I-10 Br
6,000
E-24 5,500
E-22 5,600
Indian Bayou
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
Trout Bayou
E-27 4,800
5,000

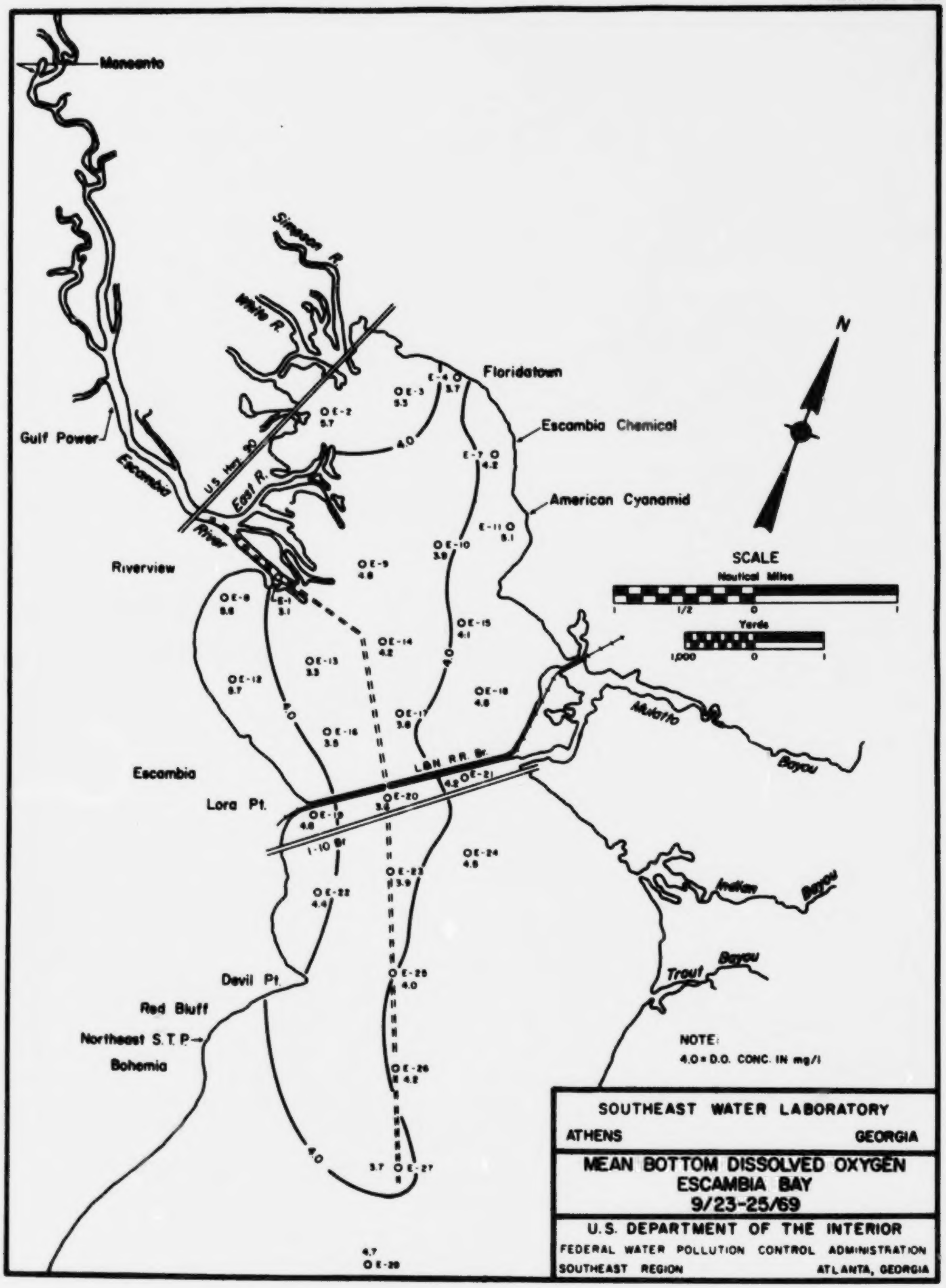
NOTE:
CURRENT: EBBING
TIME OF COLLECTION: 1000 HRS TO 1400 HRS CONC. IN CELLS PER ml.

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

TOTAL LIVE ALGAE
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 29


Monsanto
Simpson R.
White R.
U.S. Hwy. 90
East R.
Escambia
River
Gulf Power
Floridatown
Escambia Chemical
American Cyanamid
Riverview
Escambia
Lora Pt.
Devil Pt.
Red Bluff
Northeast S.T.P.
Bohemia
Mulatto
Bayou
Indian
Bayou
Trout
Bayou
L&N R.R. Br.
I-10 Br.
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1
E-1
3.1
E-2
3.7
E-3
3.3
E-4
3.7
E-7
4.2
E-8
3.6
E-9
4.8
E-10
3.9
E-11
5.1
E-12
3.7
E-13
3.3
E-14
4.2
E-15
4.1
E-16
3.5
E-17
3.8
E-18
4.8
E-19
4.8
E-20
3.6
E-21
4.2
E-22
4.4
E-23
3.9
E-24
4.5
E-25
4.0
E-26
4.2
E-27
3.7
E-28
4.7
4.0
4.0
4.0
4.0
4.0
NOTE:
4.0 = D.O. CONC. IN mg/l

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

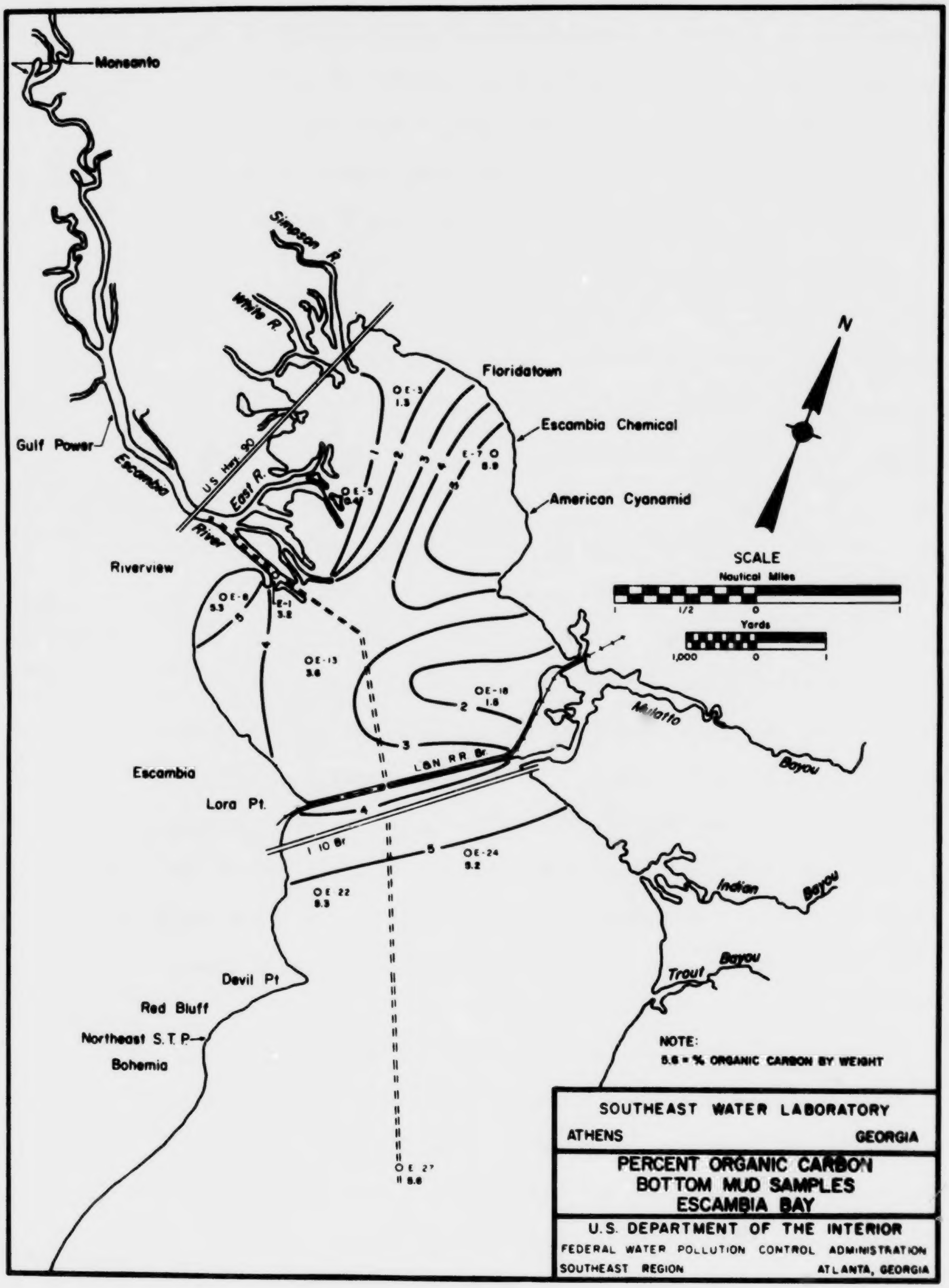
MEAN BOTTOM DISSOLVED OXYGEN
ESCAMBIA BAY
9/23-25/69

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

Reaeration, as a means of increasing DO is negligible due to the salinity stratification and poor vertical mixing. If bottom material contains greater than 3.0% organic carbon content by weight, it will most likely exert a high oxygen demand on the overlying water and can be characterized as a sludge deposit. (10) By this criterion, a significant proportion of the bottom of Escambia Bay, north of the L & N Bridge amounting to more than 57% of the area is covered with a blanket of oxygen demanding sludge. The only sections with less than 3% organic carbon content are the extreme northern part, and the area around the mouth of Mulatto Bayou. The sludge distribution in Escambia Bay is shown in Figure 30. The highest concentrations of sludge deposits in Escambia Bay are centered around the American Cyanamid and Escambia Chemical outfalls. Organic carbon content in this area is nearly 6%. The percentage of volatile solids, based on total solids, in the effluents of American Cyanamid and Escambia Chemical are 72% and 93% respectively. Monsanto Company discharges 48% volatile solids and Container Corporation discharges 80% volatile solids. Some of this volatile solid load from these latter industries contributes to the sludge deposits in the central portion of the bay north of the L & N railroad bridge. Upstream land runoff in the Escambia River watershed also deposits volatile solids in Escambia Bay.

The entire upper section of Escambia Bay north of the L & N rialroad bridge is in a state of accelerated eutrophication as shown by unstable DO variations caused by excessive phytoplanktonic photosynthesis and respiration; high carbon nitrogen and phosphorus concentrations; and excessive oxygen demanding sludge deposits.

FIGURE 30


Monsanto
Simpson R.
White R.
Floridatown
Escambia Chemical
American Cyanamid
Gulf Power
U.S. Hwy. 90
East R.
Escambia River
Riverview
E-3
1.3
E-7
8.9
E-5
0.4
1
2
3
4
5
E-8
5.3
E-1
5.2
E-13
3.6
E-18
1.8
Mulatto Bayou
Escambia
Lora Pt.
L&N RR Br.
I 10 Br.
E-24
5.2
E 22
5.3
Indian Bayou
Trout Bayou
Devil Pt
Red Bluff
Northeast S.T.P.
Bohemia
E 27
5.6
N
SCALE
Nautical Miles
1
1/2
0
1
Yards
1,000
0
1

NOTE:
5.6 = % ORGANIC CARBON BY WEIGHT

SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

PERCENT ORGANIC CARBON
BOTTOM MUD SAMPLES
ESCAMBIA BAY

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

The major sources of artificial pollution causing these conditions are the Escambia Chemical Company, American Cyanamid Company and, to a lesser extent, the Monsanto Company. Container Corporation of America and the Northeast sewage treatment plant are relatively minor contributors of carbon and phosphorus, in terms of the effects on water quality in the bay.

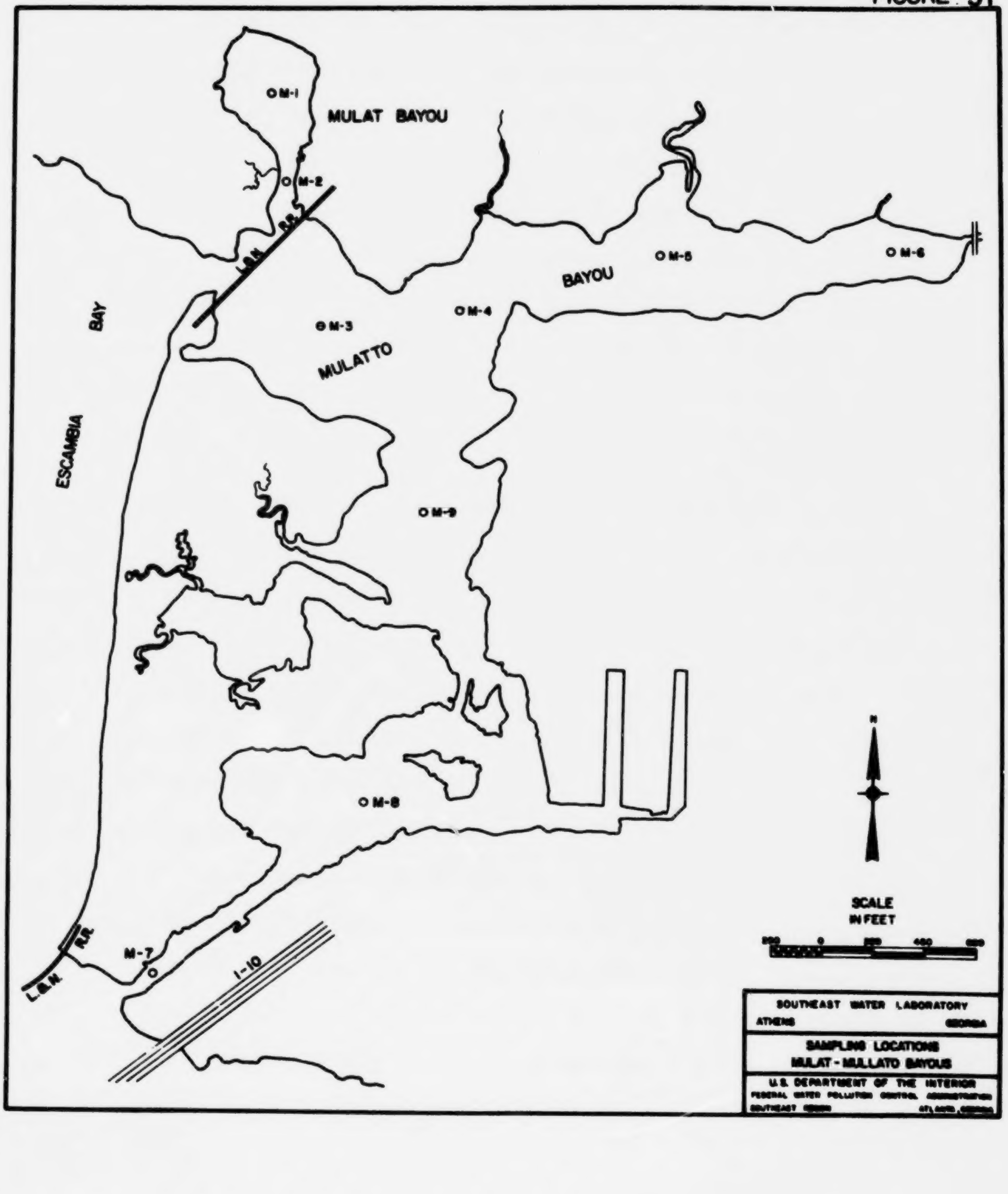
The lower section of the bay south of the L & N railroad bridge is also in a degraded state due to sludge deposits. The only factor preventing an identical condition to upper Escambia Bay is the flushing and exchange of pollution out of the area in a relatively short period of time.

MULAT-MULATTO BAYOU

Many of the reported fish kills in 1969 occurred in Mulat-Mulatto Bayou on the eastern side of Escambia Bay. Within the past five years, a new opening to Escambia Bay, connecting to the southern arm of the Bayou, has been dredged. The bottom material removed was used as fill for the new I-10 bridge and in some sections, this new channel is more than twenty feet deep. This compares to an average depth, at low water, of about five feet in Escambia Bay off the bayou and about four feet in the bayou. Joining this new channel, a series of canals, dredged for a nearby residential area, have recently been constructed. These physical alterations have deleteriously affected the natural flushing and exchange of material from Mulat-Mulatto Bayou.

Water quality in Mulat-Mulatto Bayou is listed in Table 7 and the sampling locations are illustrated in Figure 31.

FIGURE 31


M-1
MULAT BAYOU
M-2
L&N R.R.
BAYOU
M-5
M-6
M-4
M-3
MULATTO
BAY
ESCAMBIA
M-9
M-8
N
SCALE
IN FEET
200
0
200
400
600
L&N R.R.
M-7
I-10
SOUTHEAST WATER LABORATORY
ATHENS
GEORGIA
SAMPLING LOCATIONS
MULAT - MULLATO BAYOUS
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION
ATLANTA, GEORGIA

Dissolved oxygen on the surface was between 8 to 10 mg/l with the highest values being observed in Mulat Bayou. These concentrations are greater than saturation and indicate excessive photosynthesis. At the four foot depth, DO was generally satisfactory at about 4 mg/l. However, in the borrow area, DO is completely absent below this depth. Furthermore, concentrations of total nitrogen and total phosphate at the 20 foot depth are ten to 20 times greater than in all other areas of the bayou.

The borrow area has become a settling basin for suspended organic material including algal organisms. The very high oxygen demand of this material has totally depleted DO and has turned this area into an anaerobic digester of organic wastes. During the ebbing current, this deoxygenated water and suspended and dissolved waste material is carried into Escambia Bay as previously discussed, and into the main section of Mulatto Bayou. The source of these organic deposits are: siltation from dredging of the canals for adjacent residential development; wastes from Escambia Chemical and American Cyanamid, (and, under certain current conditions, in lesser concentrations, Monsanto Company and Container Corporation) which come in through the northern entrance to Mulat-Mulatto Bayou; and deposits from dead algal and bacteria growths resulting from the excessive nutrient concentrations in the bayou.

Although Mulat-Mulatto Bayou is a desirable nursery area for sport fish, visual observation indicates that the entire bottom is covered with a thick organic ooze which emits a pronounced hydrogen sulfide odor when disturbed. Most of the bottom grasses, which are feeding grounds for fish, have been replaced by these sludge beds.

TABLE 7
WATER QUALITY - MULAT - MULATTO BAYOU
MEAN VALUES

STATION LOCATION	DEPTH FT.	Cl^-	D.O.	T.K.N.	AMMONIA-N mg/1	NO_2NO_3-N	TOTAL PO_4	ORTHO PO_4	TOTAL LIVE ALGAE CELLS/ml
M-1	1	11,900	7.9	1.52	0.39	<0.008	0.165	0.032	-
M-2	2	11,500	5.9	0.71	0.10	<0.006	0.094	0.039	-
M-3	1	11,200	6.8	0.76	0.15	<0.007	0.082	0.032	1711
	4	11,900	6.1	0.79	0.03	0.010	0.045	0.035	-
M-4	1	11,450	8.2	0.99	0.26	<0.005	0.074	0.033	-
	4	11,800	8.2	0.57	0.17	<0.005	0.071	0.033	-
M-5	1	11,200	7.3	0.71	0.29	<0.005	0.101	0.037	1052
	3	11,400	6.6	-	0.53	0.007	0.047	0.042	-
M-6	1	11,000	6.4	0.77	0.33	<0.005	0.098	0.042	-
M-7	1	11,800	4.0	0.89	0.37	<0.006	0.063	0.023	-
	5	13,000	3.8	0.47	0.12	0.005	0.052	0.019	-
M-8	1	12,600	7.7	0.73	0.09	<0.009	0.045	0.032	-
	10	13,800	2.9	1.38	0.64	<0.005	0.089	0.034	-
	20	14,400	0	11.50	10.90	<0.005	0.930	0.095	-
M-9	1	12,100	7.2	1.60	0.56	0.009	0.130	0.035	1236

The combination of waste input; poor circulation caused by alteration of the natural physical configuration; and dredging practices are the major causes of the fish kills occurring in Mulat-Mulatto Bayou.

ESCAMBIA RIVER

1) Background

There have been numerous studies of the Escambia River by state and federal agencies and by industry. These reports and all data that were available for review are summarized as follows:

1. There has been an increase in color below the Container Corporation plant at Brewton, Alabama (11, 12, 13, 14). The color increase has been particularly pronounced since 1964-65 and is apparent a considerable distance into Florida (13, 14).
2. Total coliform levels were found to be elevated at stations below the junction of Murder and Conecuh Creeks and extending downstream to Highway 4 bridge at Century (11, 12, 15).
3. Slime growths attributable to wastes from Container Corporation are present in the river and in some years have been apparent as far downstream as Highway 4 bridge at Century (14, 16).
4. Studies of the aquatic biota have shown that the diversity and quality of the macro-invertebrate populations in a limited reach of river below the Container discharge are reduced.

The section of river in which the biota is appreciably affected has varied from year to year but has been generally restricted to the reach between Container discharge and the Alabama-Florida state line (14, 15, 16). The station at Highway 4 bridge near Century has been intensively studied for a period of over 10 years and, with the exception of 1961, the river at this station has supported a diverse and healthy community of aquatic macro-invertebrates (11, 12, 14, 15, 16, 17, 18, 19, 20). In 1961, a fish kill attributed to a spill of wood preservative chemical occurred and benthic studies at Century (16, 20) indicated a reduction in the quality and diversity of the fauna.

2) Water Quality and Biology

During the waste source survey and the biological survey conducted in September and October respectively, grab samples for the determination of dissolved oxygen (DO, pH, BOD, TOC, and color were collected at most of the river stations sampled (Appendix IV). Sample locations are described in Appendix II and and shown on Figure 3.

Dissolved oxygen was consistently high in the White River and at all Escambia River stations above the Monsanto outfall (C-1 through E-8 and W-11). At stations E-9, E-10, and E-12 below Monsanto the surface DO was high but in the deeper waters oxygen was depressed to level ranging from 1.5 mg/l to 3.2 mg/l.

Similar results were obtained by Hopkins (21) in studies conducted during the summer of 1969.

Color levels increase 40-50 units in the Conecuh River immediately below the Container Corporation outfall. These high levels are still apparent in the Escambia River at Century (Station E-5), but are reduced to near background at Highway 184 bridge (Station E-6) approximately 40 miles downstream.

The effect of waste sources on oxygen demand is demonstrated by the elevated biochemical oxygen demand (BOD) at Station C-1 (Brewton, Alabama STP), Station C-3 and C-5 (Container Corporation), and Station E-9 (Monsanto Chemical Corporation).

As discussed in the review of previous studies, the Escambia River at Highway 4 near Century, Florida, has been intensively studied for many years, and with the exception of a period in 1961 this station has supported a diverse community of organisms exceptionally rich in species.

In 1965, 1966, 1968, and 1969 the Federal Water Pollution Control Administration collected biological data at Century as part of a regional surveillance program. (Appendix VI) These data were collected by the placement of artificial substrate samplers (see Appendix II) for a period of 4 to 6 weeks during the period of low flow from July through September.

Biotic diversity (H) ranged from highs of 4.8 and 4.1 in 1965 and 1969, respectively, to lows of 3.1 and 2.4 during 1968 and 1966, respectively (Table 8). Equitability (E) was also high in 1965 and 1969 (mean of 0.74 and 0.65, respectively), but was severely reduced in 1966 and 1968 (mean of 0.26 and 0.41 respectively).

Diversity (H) is a function of both richness of species and equitability (E) or evenness in the distribution of individuals among the species. Richness of species in turn is primarily a function of the structural diversity of the habitat while equitaility provides a sensitive measure of subtle physical and/or chemical alterations of the aquatic habitat.

The levels of diversity (H) found during 1965 and 1969 at Century are comparable to levels of diversity found at surveillance stations studied in the southeastern United States where the waters are known to be of high quality. The diversity in 1966 and 1968

TABLE 8

DIVERSITY OF MACROINVERTEBRATE COMMUNITIES AS COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS FROM ESCAMBIA RIVER NEAR CENTURY, FLORIDA

SAMPLING INTERVAL	NUMBER OF SPECIES	NUMBER OF INDIVIDUALS	INDEX OF DIVERSITY (H)	EQUITABILITY COEFFICIENT (E)
10/21 - 11/18/65	38	324	4.12	0.68
10/21 - 11/18/65	42	185	4.31	0.69
10/21 - 11/18/65	62	569	4.82	0.68
10/21 - 11/18/65	45	224	4.78	0.91
06/23 - 08/18/66	38	955	3.42	0.39
06/23 - 08/18/66	48	2281	2.60	0.17
06/23 - 08/18/66	35	1182	2.61	0.23
06/23 - 08/18/66	27	1062	2.41	0.26
06/27 - 08/12/68	31	555	3.11	0.39
06/27 - 08/12/68	28	1047	3.06	0.43
08/04 - 09/10/69	32	234	3.79	0.59
08/04 - 09/10/69	29	144	3.34	0.52
08/04 - 09/10/69	33	180	4.12	0.79
08/04 - 09/10/69	23	95	3.47	0.70

found in other southeastern rivers which are known to be degraded by oxygen demanding wastes. Since the numbers of species found in 1966 and 1968 are comparable to those found in 1965 and 1969, the reduction in diversity must be a function of the equitability component.

Equitability levels below 0.50 have not been encountered in southeastern streams known to be unaffected by oxygen demanding wastes and in such streams "E" generally ranges between 0.6 and 0.8. From this standpoint, the biota in the Escambia River at Century during the periods of study in 1965 and 1969 were not degraded by wastes from upstream sources. In 1966 and 1968 the imbalance in the distribution of abundances of species is indicative of a degradation of the habitat at the time surveillance studies were conducted.

Flows during late summer in both 1966 and 1968 were much lower than normal. Flows during the time samples were in place were near 1,000 cfs and, in September 1968, the low flow of record was reported at the Century station. In 1965 flows at Century during the period of study ranged from 2,000 to 8,000 cfs, more than double the flow in 1966. Flow data were not available for the summer of 1969, but the dissolved oxygen as recorded by the monitor at Century was rarely below 5.0 mg/l and was never below 4.5 mg/l from July through September, 1969.

From July through September 1969, dissolved oxygen readings at Century, as recorded by an FWPCA automatic quality monitor, were never below 4.5 mg/l. An examination of the frequency distribution (at 0.5 mg/l intervals) of the dissolved oxygen values at Century as shown in Figures 32,33 and 34 indicate that levels were above 5.0 mg/l 82 percent, 90 percent, and 100 percent of the time during July, August, and September, respectively.

On October 22, 1969 qualitative samples of benthic macroinvertebrates were collected at Stations C-1 to C-5 from Brewton, Alabama, downstream to Century, Florida (Appendix V).

Numbers of species collected ranged from 25 to 37 at stations above Container Corporation to 29 and 30 species at the station below Container Corporation. Many species intolerant of depressed oxygen levels were collected at all stations sampled.

The diverse community of macroinvertebrates encountered at these stations are indicative of healthy stream conditions at the time of sampling and for a period of at least two to four weeks prior to the time of sampling.

For the reach of river immediately below the Container Corporation outfall (Station C-3 of this study), these data are somewhat at variance with the results of previous studies. It should be pointed out that the high flows which occurred in September 1969 completely resorted bottom materials, redistributed benthic organisms and would have tended to equalize the distribution of invertebrates throughout the entire reach of stream studied. During this period, dissolved oxygen levels were adequate to support a thriving community of benthic organisms.

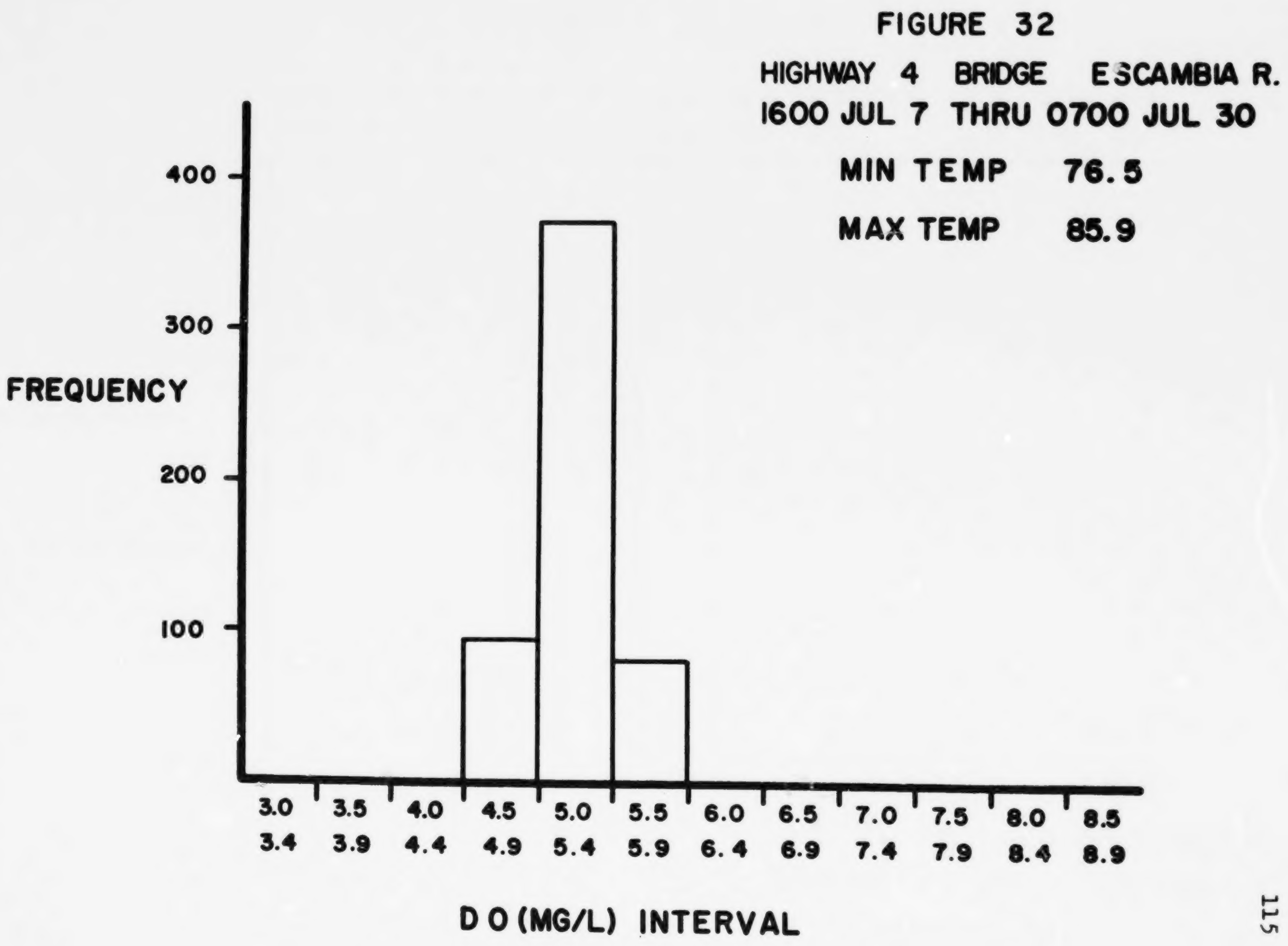


FIGURE 32

HIGHWAY 4 BRIDGE ESCAMBIA R.
1600 JUL 7 THRU 0700 JUL 30

MIN TEMP 76.5

MAX TEMP 85.9

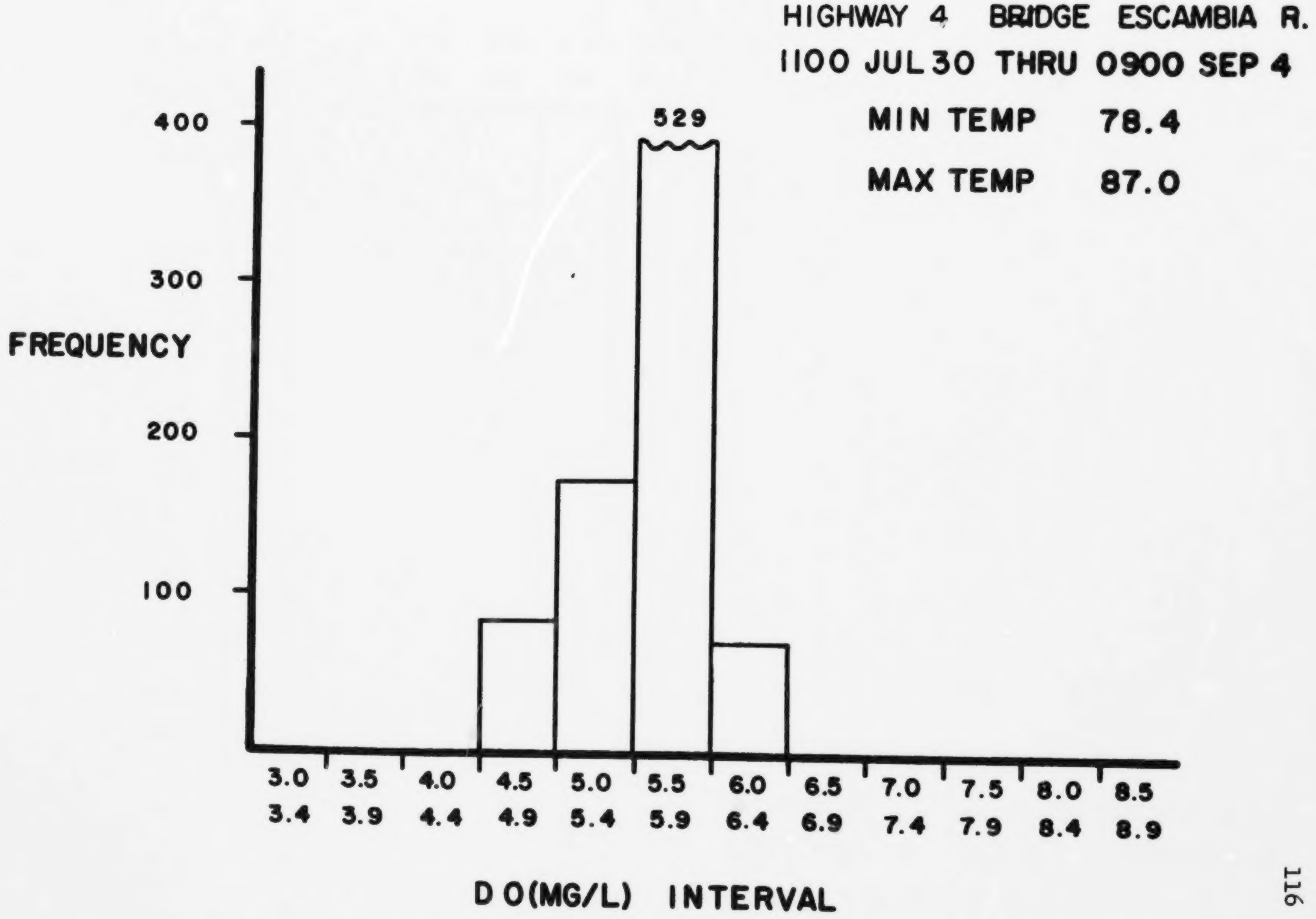
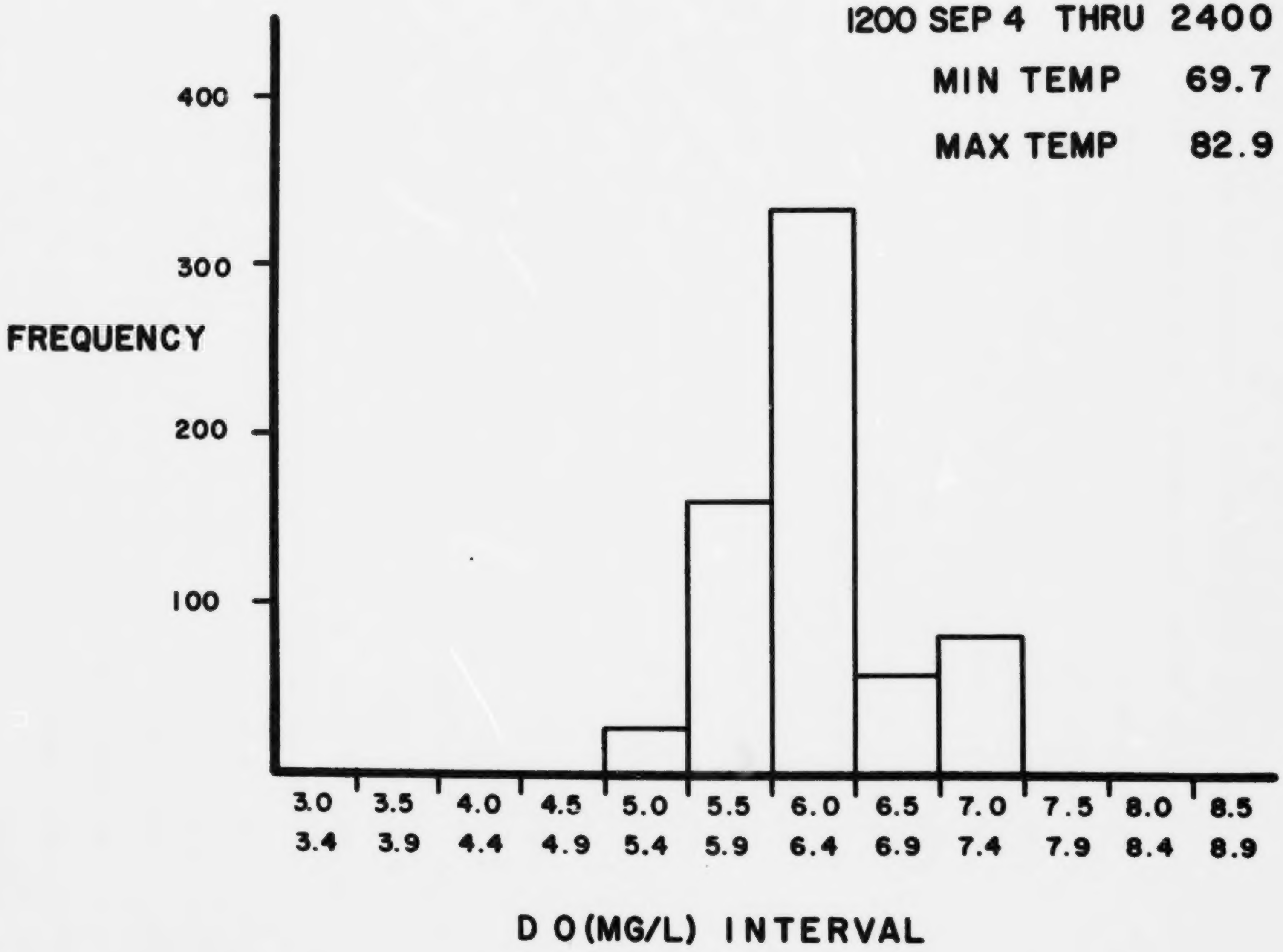


FIGURE 33

HIGHWAY 4 BRIDGE ESCAMBIA R.
1100 JUL 30 THRU 0900 SEP 4
MIN TEMP 78.4
MAX TEMP 87.0

FIGURE 34

HIGHWAY 4 BRIDGE ESCAMBIA R.
1200 SEP 4 THRU 2400 SEP 30
MIN TEMP 69.7
MAX TEMP 82.9



VII. ABATEMENT

The present ecological imbalance of Escambia Bay and Mulat-Mulatto Bayou did not occur suddenly. The water quality degradation has developed over many years from discharging untreated and inadequately treated waste and from uncoordinated alteration of the bay's natural physical configuration, thereby adversely affecting flushing, exchange, and circulation. Restoration of water quality which will support a wide diversity of desirable water uses requires immediate adoption and enforcement of abatement regulations for all municipal and industrial polluters.

The carbon, nitrogen, and phosphorus discharges from Escambia Chemical Company, American Cyanamid Company, the Northeast sewage treatment plant of Pensacola, Monsanto Company, and Container Corporation of American should be reduced to levels that will not stimulate the excessive activity of floating algae and bacteria which is the major cause of the fish kills in the bay and in Mulat-Mulatto Bayou.

Recent literature reports have indicated that the availability of carbon dioxide is a major factor in accelerated eutrophication (22). The concentration of available carbon dioxide is a function of the carbonaceous material discharged from waste sources, uncontrollable inputs from land drainage and upstream river runoff, and from atmospheric diffusion. The concentration of carbon dioxide resulting from atmospheric diffusion will range from 0.4 to 1.0 mg/l. Because the uncontrollable inputs are highly variable, the contribution of carbon from artificial sources should not exceed the relatively constant input resulting from atmospheric diffusion. To maintain this level, the concentration of unstabilized carbon in Escambia Bay from artificial sources should not exceed 0.26 mg/l. The average TOC concentration in Escambia Bay is about 4 mg/l. This would require a minimum 94% reduction of carbonaceous material from all present and future waste sources.

The Monsanto Company should not discharge more than 605 pounds per day of five-day BOD nor more than 282 pounds per day to total organic carbon. Escambia Chemical should discharge no more than 17 and 12 pounds per day of five-day BOD and TOC respectively. Assuming that the primary treatment facilities remove 37% of the carbonaceous waste, American Cyanamid should discharge not more than 425 pounds per day of five-day BOD nor more than 500 pounds per day of TOC. Container Corporation of America and the Northeast sewage treatment plant presently remove about 80% of their carbonaceous waste. At a removal efficienty of 94%, Container Corporation should discharge not more than 2,230 pounds per day of five-day BOD nor more than 3,120 pounds per day of TOC. In the Escambia River between Brewton, Alabama, and Escambia Bay this waste effluent will be reduced an additional 80% by stabilization in the river. Therefore, the five-day BOD contribution from Container Corporation to Escambia Bay will be about 450 pounds per day. The Northeast sewage treatment plant effluent should contain not more than 137 pounds per day of five-day BOD nor more than 39 pounds per day of TOC.

The most important constituents of the nitrogen series which can be utilized quickly by algae are ammonia and nitrates. The

Wacasassa estuary in Florida which is unpolluted by artificial sources of waste has nitrate nitrogen concentrations of 0.03 mg/l (23). The average concentration of ammonia plus nitrite-nitrate nitrogen in Escambia Bay is 0.49 mg/l. Therefore, a reduction of at least 94% of nitrogen material is required from all present and future waste sources. Escambia Chemical Company effluent should contain no more than 197, 137, and 143 pounds per day of total Kjeldahl nitrogen, ammonia nitrogen, and nitrite-nitrate nitrogen respectively. American Cyanamid should discharge no more than 249, 32, and 42 pounds per day of TKN, ammonia nitrogen, and nitrite-nitrate nitrogen respectively. The TKN, ammonia nitrogen, and nitrite-nitrate nitrogen in the Monsanto effluent should not exceed 102, 66, and 80 pounds per day respectively. Container Corporation effluent should contain no more than 30 and 12 pounds per day of TKN and ammonia nitrogen. The Northeast sewage treatment plant should discharge no more than 101 and 84 pounds per day of TKN and ammonia nitrogen. The latter two polluters discharge negligible amounts of nitrite-nitrate wastes.

The amounts of phosphate required to stimulate algae blooms exceed about 0.01 mg/l in observed situations (22). The average concentration of total phosphorus in Escambia Bay is 0.09 mg/l. A 90% reduction of phsophorus material is required from all present and future waste sources. Escambia Chemical Company should be limited to 35 pounds per day each of total and ortho-phosphate. Monsanto Company should discharge not more than 46 and 29 pounds per day of total and ortho-phosphate. The Northeast sewage treatment plant effluent should not exceed 23 and 12 pounds per day, and

Container Corporation should discharge not greater than 17 and 8 pounds per day of total and ortho-phosphate. The American Cyanamid Company discharges a negligible amount of phosphate material.

All waste sources should provide complete removal of settleable solids.

If each waste source constructs individual treatment facilities to achieve the required reductions, more detailed studies of the circulation in Escambia Bay should be undertaken under a wider variation of fresh water inflow and tidal current movement. The results of these studies will determine optimal outfall locations and maximum dilution potential in the bay to prevent the unequal distribution of waste now occurring in the northern and eastern sections of Escambia Bay.

Individual waste treatment facilities for all present and future sources is one alternative to achieve the required 94%, 94%, and 90% reductions in carbonaceous, nitrogenous, and phosphorus material respectively. However, the residual amounts of nutrient material from artificial sources, in addition to natural sources such as land runoff, will still continue to be discharged to Escambia Bay. Accelerated eutrophication of the bay would continue, although at a substantially reduced and slower rate. The most desirable alternative would remove as close as possible to 100% of all nutrient discharges from artificial sources. This would effectively halt the process of accelerated eutrophication and would obviate the need for any circulation studies with respect to outfall locations.

The Escambia Bay area is developing rapidly on both the eastern and western shoreline, and increasing amounts of wastes will be discharged from future sources even with the recommended removal efficiencies for carbon, nitrogen, and phosphorus. Therefore, the most effective waste management program will provide for this future expansion and development by considering the problem as part of a metropolitan area planning concept.

The recommended alternative is the construction of a sewer interceptor collection system around the entire bay and in the Escambia River to the Monsanto Company. All domestic and industrial wastes would be treated at a central facility with discharge away from Escambia Bay after the recommended carbon, nitrogen, and phosphorus reductions have been accomplished. Container Corporation should meet the recommended effluent quantities through increased carbon and phosphorus removals at the plant location. This alternative would virtually eliminate the discharge of nutrients from artificial sources to Escambia Bay, partially control land runoff, and provide for future residential and industrial development.

Both Alabama and Florida require that materials producing color...resulting from municipal, agricultural, or industrial discharges that may cause deleterious effects shall not be present in the receiving waters. As has been discussed, there is a significant increase in color in the Escambia River from upstream to downstream of the Container Corporation of America waste discharge. This increased color persists to the Alabama-Florida state line. Levels of color in the Escambia River at the Alabama-Florida state line, as measured at the Highway 4 bridge near Century, Florida, should not exceed levels measured upstream of the Container Corporation waste discharge. At the present time, the Federal Water Pollution Control Administration is sponsoring several research and development grants to develop a technically and economically feasible process for color removal.

No further construction dredging should be permitted in Escambia Bay or Mulat-Mulatto Bayou until an area-wide plan for development of the shoreline has been established. At that time, construction dredging should be permitted only in accordance with this plan. This plan should be completed within one year by representatives of Escambia and Santa Rosa counties, the City of Pensacola, the State of Florida, the U. S. Army Corps of Engineers, and the U. S. Department of the Interior. Any necessary maintenance dredging in the interim should be conducted by diking the dredging area to prevent drifting of organic muds. Maintenance of existing channels should be accomplished by hydraulic pipeline dredging only. Disposal of all dredged material should be to upland site locations.

The L & N railroad trestle across Escambia Bay should be reconstructed by January 1, 1973, to eliminate the piling presently adversely affecting the circulation and exchange of water in the bay.

The American Cyanamid Company should reduce concentrations of acrylonitrile in its waste effluent to levels less than 10% of those which are toxic to fish.

The Monsanto Company and Gulf Power Company should by January 1, 1973, abate the excessive heat being discharged in their respective cooling water effluents.

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APPENDIX I
PROJECT PERSONNEL

A. Southeast Water Laboratory - FWPCA

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Paul L. Wagner	Sanitary Engineer
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Donald A. Schultz	Aquatic Biologist
Paul Frey	Aquatic Biologist
Dennis T. Cafaro	Sanitary Engineer
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Ray N. Hemphill	Chemist
Lavon H. Revells	Chemist
Thomas B. Bennett, Jr.	Chemist
Ralph E. Gentry	Microbiologist
Thomas N. Sargent	Sanitary Engineer
Jerry L. Dause	Sanitary Engineer
David R. Smith	Aquatic Biologist
Raymond T. Wilkerson	Technician
Roy A. Weimert	Technician
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Rod Presnell

C. Alabama Water Improvement Commission

Mr. E. John Williford	Biologist

The following people materially contributed to this study through use of facilities and equipment as well as supplying invaluable background dtat and material necessary to successful completion of this project.

Dr. Thomas Hopkins	University of West Florida
Mr. Wayne Tisdale	Florida Department of Health
Mr. Gordon Richmond	Florida Department of Health
Mr. Frank Skipper	Florida Department of A. & W. P. C.
Mr. William Young	Florida Department of A. & W. P. C.
Mr. Ted Ripsburger	Florida Department of A. & W. P. C.

APPENDIX II
SAMPLING PROCEDURES AND ANALYTICAL METHODS

I. PROCEDURES

A. Escambia Bay

The Escambia Bay field survey study was conducted at 6:00 a.m. on September 23rd to 6:00 p.m. on September 25th. Sampling runs began every six hours around-the-clock for the 60-hour period for a total of 10 complete runs. Each run took approximately two hours to complete.

Samples were collected at 28 pre-established bouy marker locations. The bouys were placed into position utilizing two standard surveying transits and employing triangulation techniques. Bouy 1 was placed in the mouth of the Escambia River near the shipping channel. Stations 2 through 24 were placed in a regular 3/4-mile grid pattern covering all of the Escambia Bay north and about 3/4 mile south of the L & N railway crossing. The grid pattern was laid out with bouys 19 to 21 forming the base line about 100 yards south of the L & N railroad trestle and Station 20 at the mid channel point. Stations 25 to 28 were in the shipping channel at one-mile intervals down the lower bay.

Samples were collected at one foot below the surface, one foot above the bottom, and at mid-depth. Stations located in water less than five feet deep were sampled at less than these three depths. In addition to DO, temperature, nitrogen series, TOC, pH, phosphorus series, and chlorides, plankton and mud samples were collected. DO, temperature, and chlorides were measured on each run at all of the 28 stations while samples for the remaining parameters were collected during the morning runs at 12 of these stations. Floating algae and mud samples were collected on one run only, during the first day.

B. Mulat-Mulatto Bayou

A special study of Mulat-Mulatto Bayou was conducted from 12:00 noon until 5:00 p.m. on September 19th. Two sample runs were made over the nine station route and grab samples were taken at each station using a Kemmerer sampler. Parameters measured included DO, temperature, pH, TOC, nitrogen series, phosphorus series, and chlorides. Floating algae samples were also collected at the one-foot level.

The sampling stations are as follows:

M-1 - Center of Mulat Bayou

M-2 - Mulat Bayou at McCmilan's Fish Camp

M-3 - Mulatto Bayou 200 yards west of L & N railroad tracks

M-4 - Mulatto Bayou near the junction of the two main arms

M-5 - Mulatto Bayou, eastern arm about ½ mile above junction

M-6 - Mulatto Bayou, eastern arm about ½ mile above junction

M-7 - Southern connector channel near I-10

M-8 - Borrow pool

M-9 - Mulatto Bayou, southern arm about ¼ mile above junction

Samples were collected at one foot below the surface, one foot above the bottom, and at mid-depth. If the total depth was less than five feet, fewer than these three depths were sampled.

C. Waste Source Survey

Grab samples were collected from the effluents of the Monsanto Company, Container Corporation of America, Escambia Chemical Company, American Cyanamid Company, and the City of Pensacola Northeast sewage treatment plant. Sampling was conducted during the period September 10 through 20, 1969, at random times during all phases of the 24-hour production schedule. No notice of collection time was given to any of the waste sources other than the initial general contact. Between four and six samples were collected from each source.

Parameters analyzed included: five-day BOD, total organic carbon, nitrogen series, phosphorus series, and total and volatile solids. The effluents from Monsanto Company, Escambia Chemical, and American Cyanamid were examined by gas chromatography and mass spectrophotometry for complex organic chemicals.

D. Escambia River

The descriptions and locations of the stations are as follows:

C-1 - Conecuh River (river mile 7.8) upstream from the Alabama-Florida state line (Escambia

River mile 58.2) and slightly downstream from Container Corporation water intake and confluence of Murder Creek

C-2 - Conecuh River (river mile 4.3) upstream from Alabama-Florida state line and just upstream from Container Corporation outfall

C-3 - Conecuh River (river mile 2.3) upstream from Alabama-Florida state line at Pollard Landing downstream from Container Corporation outfall

BE-4 - Big Escambia Creek (river mile 2.0) at first bridge crossing upstream from confluence with Escambia River (river mile 50.2).

E-5 - Escambia River (river mile 48.8) at Florida Highway 4 bridge near Century, Florida

E-6 - Escambia River (river mile 13.5) at Florida Highway 184 bridge

E-7 - Escambia River (river mile 10.8) slightly upstream of upper confluence with White River near Ruth Patricks 1951 survey station P-1

E-8 - Escambia River (river mile 7.1) 0.4 mile upstream of Monsanto outfall

E-9 - Escambia River (river mile 6.3) 0.4 mile downstream from Monsanto outfall near Ruth Patricks 1951 survey station P-3

E-10- Escambia River (river mile 3.75) a short distance upstream from the lower confluence with White River near Ruth Patricks 1951 survey station P-4

W-11 - White River (river mile 2.2) upstream from lower confluence with Escambia River (river mile 3.6) and 200 feet upstream of gasline canal

E-12 - Escambia River (river mile 3.3) midway between Thompsons and Governors bayous

E-13 - Escambia River (river mile 2.6) near Coast Guard Bouy #26 slightly upstream of Gulf Power Company waste effluent ditch

E-14 - Escambia River (river mile 1.6) at U. S. Highway 90 bridge near Ruth Patricks 1951 survey station P-5

This mileage was computed from FWPCA 1968 map measurements. Zero mileage was set at Coast Guard Bouy #20 located in the main channel of the Escambia River mouth east of Riverview, Florida.

II. METHODS

A. Chemical Analyses

1. Total Kjeldahl Nitrogen (Automated Phenolate Method)

TKN is defined as the sum of free ammonia and organic nitrogen compounds which are converted to ammonia sulfate under the specified digestion conditions. The samples are automatically digested with a sulfuric acid solution containing potassium sulfate and mercuric sulfate as a catalyst to convert organic nitrogen to ammonium sulfate. The solution is then automatically neutralized with a sodium hydroxide solution and treated with alkaline phenol reagent and sodium hypochlorite reagent. This addition forms a blue color designated as indophenol. Sodium nitroprusside, which increases the intensity of the color, is added to obtain necessary sensitivity for measurement of low level nitrogen. The reaction color is measured at a wavelength of 630 . The TKN of the samples is compared against standards of urea carried through the entire procedure.

The bottom samples were digested by the manual method (12th Edition, Standard Methods) followed by pH adjustment and nitrogen analysis by the method below (2). The automated procedure for TKN is the SEWL standard method and appears in FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969.

2. Ammonia Nitrogen (Automated Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969)

   Ammonia nitrogen is analyzed for its reaction with alkaline phenol hypochlorite. The intensity of the indophenol blue color which is formed is measured at 630 . Ammonium sulfate standards are used for calibration.

3. Total Nitrate-Nitrite Nitrogen (Automated Cadmium Reduction Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969)

   This method is used to determine nitrates and nitrites singly or combined. The initial step of the procedure is to reduce nitrates to nitrites by using a cadmium-copper reduction column. The nitrites are then diazotized and coupled to form the azo dye. The dye intensity of both samples and standards is then measured at a wavelength of 540 .

4. Phosphorus (Automated Ascorbic Acid Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969)

   Phosphorus is reacted with ammonium molybdate and potassium antimonyl tartrate to form an antimony-phosphate-molybdate complex. This complex is reduced to an intensly blue colored complex by ascorbic acid. The color is proportional to the phosphorus concentration. The total phosphorus analysis on the water and bottom samples was carried out by this procedure preceeded by acid persulfate digestion.

5. Total Organic Carbon (FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969)

   A micro sample of water is injected into a catalytic combustion tube heated to 950° C. The carbonaceous material is oxidized to carbon dioxide. An oxygen stream carries the CO_2 to an infrared analyzer sensitized to provide a measure of CO_2. The amount of CO_2 present is directly proportional to the concentration of carbonaceous material in the injected sample. The instrument used for this analysis is the Beckman Carbonaceous Analyzer, Model No. 915, dual channel.

6. Chemical Oxygen Demand (FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969)

   Organic materials in water samples are oxidized by potassium dichromate solution in 50% sulfuric acid. The excess dichromate is titrated with standard ferrous ammonium sulfate using ferroin as an indicator. The amount of dichromate used in the oxidation is proportional to the amount of organic and oxidizable inorganic matter in the sample. This procedure was used for analyzing both water and mud samples.

7. Chlorides (Automated Ferricyanide Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969)

   Thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by chloride ion to form unionized mercuric chloride. In the presence of ferric ion, the liberated thiocyanate forms highly colored ferric thiocyanate, in concentration proportional to the original chloride concentration.

8. Biochemical Oxygen Demand, Total Solids, Total Volatile Solids, and Color

   These analyses were all carried out by the procedures outlined in Standard Methods for the Examination of Water and Waste Water, 12th Edition, 1965.

B. Biological Methods - Escambia River

Data on the aquatic macro-invertebrates were collected with artificial substrate samplers and by qualitative hand collections.

The artificial substrate samplers used were wire baskets containing 1½' to 3" diameter crushed limestone as described by Mason, et. al. (1967)(1). Three replicate samplers were submerged at a depth of three feet at Station E-5. After four to six weeks exposure the samplers were retrieved, the organisms removed and preserved in labled vials of 70% ethyl alcohol. The utility of these samplers lies in the fact that they provide a uniform substrate for quantitative comparisons of the kinds and numbers of organisms which are found at the different stations.

Data from these samplers were used to calculate indices of diversity using information theory techniques. There are two components of species diversity:

1. richness of species and
2. equitability in the distribution of individuals among the species.

Diversity was calculated using the Shannon-Wiener function:

$$H = - \sum_{r=1}^{s} P_r \log_2 P_r$$

Where H = mean diversity per individual, P = proportion of individuals belonging to the r^{th} species and s = number of species.

Equitability (E) was calculated by the method of Lloyd and Ghelardi (1964)(2).

"H", as calculated, is a combined measure of richness of species and equitability of distribution of these species in the sample while "E" is a measure of the equitability of distribution of these species in the sample while "E" is a measure of the equitability or evenness of distribution of species. As calculated, "E" and "H" may range in value from zero to one, and from zero to 3.321928 log N respectively (N = total number of individuals).

Diversity serves as an excellent objective measure of environmental disturbance because any physical or chemical alteration in the aquatic habitat tends to favor certain species while reducing or eliminating those species which would normally be present under undisturbed conditions.

Richness of species is a measure of the structural diversity of the habitat and except under conditions of extreme degradation (anoxic conditions, toxic materials, lethal temperatures) is often relatively insensitive to subtle environmental changes. Equitability (E) or evenness of distribution of individuals among the species is a sensitive measure of the stability of the physical and chemical characteristics of the habitat.

By using a uniform substrate, differences in diversity and equitability resulting from the physical structure of the habitat are kept to a minimum; hence reductions in these indices, particularly "E", may be attributed to differences in the chemical (oxygen levels, pH, alkalinity, etc.) and/or physical (temperature, turbidity, etc.) characteristics of the aquatic environment.

Qualitative collections were made by examining rocks, vegetation, and debris and hand picking all macroinvertebrates which could be found. This method of sampling provides a qualitative estimate of the richness of species and was used because the artificial substrate samplers available could not be used for sampling the shallow waters of the upper reaches of the river.

C. Water Quality Monitor - Century, Florida

A four parameter Schneider water quality monitor was placed in operation on the Escambia River at Century during June 1969. This instrument measures DO, temperature, pH, and conductivity and was constructed on the basis of Federal Water Pollution Control Administration specifications which for dissolved oxygen require an accuracy of ± 0.24 ppm.

The monitor is serviced weekly by personnel from the Florida Department of Air and Water Pollution Control and monthly by personnel from the Southeast Water Laboratory of the Federal Water Pollution Control Administration. At each servicing, prior to cleaning of the sensors, the dissolved oxygen reading is checked against a chemical determination using the Sodium Azide modification of the Winkler technique as described in Standard Methods for the Examination of Water and Waste Water, 12th Edition. Any difference between the monitor reading and the Winkler determination is reported as a plus or minus correction factor and the data adjusted accordingly.

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APPENDIX III

WASTE SOURCE SURVEY
SUMMARY OF DATA
ESCAMBIA BAY

Date	Flow (mgd)	Temperature (°C)	BOD (mg/1)		pH	Nitrogen Series (mg/1)			Phosphorus Series (mg/1)		Total Organic Carbon (mg/1)
			2-day	5-day		Kjeldahl	NH_3	NO_2-NO_3	Total P	Ortho P	
1969											
Container Corporation of America (A-1)											
9/17	36	25	25.6	28.5	7.3	1.36	0.12	0.005	0.520	0.242	39
9/17	36	25	24.8	32.0	7.2	1.46	0.16	0.030	0.490	0.244	36
9/18	36	24	3.5	11.3	7.3	1.12	0.15	$<$0.005	0.520	0.262	34
9/19	36	24	12.5	19.5	7.3	2.14	2.08	0.010	0.520	0.247	34
9/19	36	26	14.5	23.0	7.5	2.41	1.15	0.015	0.490	0.220	34
9/20	36	29	16.4	34.2	7.3	1.42	0.20	$<$0.005	0.450	0.247	31
American Cyanamid Company (A-3)											
9/10	4.7	32	50.8	117.2	7.8						
9/12	4.4	32	25.5	185.5	7.7						
9/13	4.3	33	30.9	93.5	8.0						
9/15	4.4	-	24.6	43.0	7.8						
9/16	4.4	35	21.0	186.5	7.9						
9/17	4.5					102	15.0	18.3	0.080	0.065	125
9/18	4.6	33	21.4	92.0	8.1	127	13.9	18.6	0.060	0.045	150
9/18	4.6					118	13.9	16.0	0.080	0.052	135
9/19	4.6					98	14.1	18.6	0.090	0.053	130
9/20	4.6					99	13.5	19.9	0.085	0.060	145

APPENDIX III (Continued)

WASTE SOURCE SURVEY
SUMMARY OF DATA
ESCAMBIA BAY

Date	Flow (mgd)	Temperature (^oC)	BOD 2-day (mg/l)	BOD 5-day (mg/l)	pH	Nitrogen Series Kjeldahl (mg/l)	Nitrogen Series NH_3 (mg/l)	Nitrogen Series NO_2-NO_3 (mg/l)	Phosphorus Series Total P (mg/l)	Phosphorus Series Ortho P (mg/l)	Total Organic Carbon (mg/l)
1969											
Escambia Chemical Company (A-5)											
9/10	4.7	28			6.5						
9/12	5.3	28			5.4						
9/13	5.3	31			6.6						
9/15	5.3	--			6.9						
9/16	5.3	31	2.7	7.8	6.6						
9/17	5.2					118	102	91.6	7.13	7.00	4
9/18	5.3	29	2.1	5.3	6.5	52.0	46.0	33.4	7.50	7.50	5
9/18	5.3					60.0	59.5	47.1	7.43	7.00	5
9/19	5.2					83.0	68.5	57.5	7.20	7.20	3
9/20	5.2					62.0	54.0	42.8	7.38	7.20	5
Monsanto Chemical Company (A-4)											
9/10	47.6	34	7.7	16.1	6.5						
9/12	49.2	35	17.5	27.7	7.4						
9/13	49.2	33	14.9	20.3	6.2						
9/15	47.6	--	19.7	26.3	6.8						
9/16	51.7	35	8.2	12.8	7.0						
9/17	50.2					3.00	1.94	1.28	0.490	0.390	9
9/18	59.5	33	10.3	20.3	6.5	2.57	1.21	1.82	0.662	0.565	6
9/19	63.5					3.50	1.70	2.77	0.470	0.212	11
9/20	54.3					6.45	4.35	5.00	1.40	0.915	6
(A-4a)											
9/12	1.9	33	60.4	90.6	7.1	2.62	2.12	2.60	4.25	0.865	6

APPENDIX III (Continued)

WASTE SOURCE SURVEY
SUMMARY OF DATA
ESCAMBIA BAY

Date	Flow (mgd)	Temperature (^oC)	BOD 2-day (mg/1)	BOD 5-day (mg/1)	pH	Nitrogen Series Kjeldahl (mg/1)	Nitrogen Series NH_3 (mg/1)	Nitrogen Series NO_2-NO_3 (mg/1)	Phosphorus Series Total P (mg/1)	Phosphorus Series Ortho P (mg/1)	Total Organic Carbon (mg/1)
1969											
			Northeast Sewage Treatment Plant (Pensacola) (A-6)								
9/10	1.0	27			6.9						
9/12	1.0	28	36.6	44.8	7.3						
9/13	1.0	28	55.0	90.6	7.5						
9/15	1.0	27	12.8	33.0	7.3						
9/16	1.0	28	24.8	70.4	7.7						
9/18	1.0	26	19.9	35.1	7.2	182	153	0.83	27.0	13.4	16
9/19	1.0					222	181	0.005	24.0	12.2	15

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E01S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1250	01.0	25.3	05.8	072.2	04650	-	-	-	-	-	-
09/23/69	1820	-	25.0	05.1	-	03020	-	-	-	-	-	-
09/24/69	0035	-	25.0	04.4	-	06190	-	-	-	-	-	-
09/24/69	0045	01.0	23.0	04.9	057.8	03280	-	-	-	-	-	-
09/24/69	1315	01.0	25.0	05.8	071.0	03400	-	-	-	-	-	-
09/24/69	1800	-	28.0	05.1	-	13250	-	-	-	-	-	-
09/25/69	0640	01.0	22.3	05.3	061.4	02720	0.26	.14	.144	0.050	0.037	-
09/25/69	0820	-	24.0	04.9	-	-	-	-	-	-	-	-
09/25/69	1345	-	25.0	05.7	-	01450	-	-	-	-	-	-

STATION NO. E01M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1250	07.5	24.8	03.6	047.2	10950	-	-	-	-	-	-
09/23/69	1820	-	25.0	03.6	-	08010	-	-	-	-	-	-
09/24/69	0035	-	25.0	04.1	-	07520	-	-	-	-	-	-
09/24/69	0045	05.5	23.0	03.5	042.7	06800	-	-	-	-	-	-
09/24/69	1315	07.0	24.5	02.4	031.9	12900	-	-	-	-	-	-
09/24/69	1800	-	25.0	03.5	-	07500	-	-	-	-	-	-
09/25/69	0640	06.0	22.5	04.8	057.5	05950	0.37	.15	.094	0.055	0.033	05
09/25/69	0820	-	24.0	05.6	-	-	-	-	-	-	-	-
09/25/69	1345	-	24.0	05.3	-	05700	-	-	-	-	-	-

STATION NO. E01B

DATE	TIME HRS	DEPTH FT	TEMP C	D.C. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0630	15.0	24.0	03.4	045.7	14700	0.37	.18	.016	0.066	0.042	03
09/23/69	1250	15.0	24.5	01.7	022.8	13780	-	-	-	-	-	-
09/23/69	1820	-	25.0	02.8	-	11190	-	-	-	-	-	-
09/24/69	0035	-	25.0	05.1	-	11900	-	-	-	-	-	-
09/24/69	0045	10.0	23.5	01.8	023.7	13840	-	-	-	-	-	-
09/24/69	1315	12.0	24.5	01.8	024.1	13800	-	-	-	-	-	-
09/24/69	1800	-	25.0	02.5	-	01700	-	-	-	-	-	-
09/25/69	0640	12.0	23.3	02.5	033.2	14910	0.33	.19	.031	0.047	0.029	04
09/25/69	0820	-	24.0	04.7	-	-	-	-	-	-	-	-
09/25/69	1345	-	24.0	04.4	-	09700	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E02S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0710	01.5	23.0	04.3	052.4	06680	-	-	-	-	-	-
09/24/69	1905	-	24.0	05.8	-	03600	-	-	-	-	-	-
09/25/69	0145	-	22.0	05.4	-	03550	-	-	-	-	-	-
09/25/69	1505	-	26.0	08.3	-	04050	-	-	-	-	-	-

STATION NO. E02M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1310	01.5	24.5	07.1	088.7	06460	-	-	-	-	-	-
09/23/69	1900	-	25.0	05.1	-	05230	-	-	-	-	-	-
09/24/69	0710	01.5	22.5	05.1	-	-	-	-	-	-	-	-
09/24/69	1330	01.5	25.0	06.8	086.2	07100	-	-	-	-	-	-
09/25/69	0650	01.5	22.5	03.8	046.5	08050	-	-	-	-	-	-

STATION NO. E02B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1900	-	25.0	-	-	-	-	-	-	-	-	-
09/24/69	1905	-	24.0	04.5	-	12400	-	-	-	-	-	-
09/25/69	0145	-	23.0	05.1	-	-	-	-	-	-	-	-

STATION NO. E03S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0710	01.0	23.5	04.8	059.4	07460	-	-	-	-	-	-
09/23/69	1345	01.0	24.5	04.2	053.9	09330	-	-	-	-	-	-
09/23/69	1915	-	25.0	05.3	-	06290	-	-	-	-	-	-
09/24/69	0725	01.0	22.5	04.6	-	-	0.46	.24	.068	0.150	0.024	03
09/24/69	1335	01.0	25.0	07.3	095.3	10150	-	-	-	-	-	-
09/24/69	1900	-	23.0	05.5	-	07700	-	-	-	-	-	-
09/25/69	0140	-	24.0	04.6	-	10600	-	-	-	-	-	-
09/25/69	0700	01.0	23.0	03.7	046.8	10520	2.88	.68	.057	0.048	0.018	07
09/25/69	1455	-	27.0	06.3	-	10750	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E03M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1915	-	25.0	-	-	-	-	-	-	-	-	-
09/25/69	1455	-	27.0	10.3	-	12300	-	-	-	-	-	-

STATION NO. E03B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0715	05.0	23.5	02.5	031.9	10500	0.51	.29	.041	0.125	0.036	03
09/23/69	1345	05.0	24.5	02.5	032.4	10480	-	-	-	-	-	-
09/23/69	1915	-	25.0	08.6	-	07460	-	-	-	-	-	-
09/24/69	0725	05.0	23.0	02.6	033.2	11510	0.47	.24	.034	0.057	0.029	03
09/24/69	1335	05.0	24.8	07.7	101.4	11300	-	-	-	-	-	-
09/24/69	1900	-	25.0	05.7	-	11650	-	-	-	-	-	-
09/25/69	0140	-	24.0	04.8	-	12700	-	-	-	-	-	-
09/25/69	0700	03.0	23.2	04.3	054.4	10280	0.47	.02	<.005	0.039	0.007	20

STATION NO. E04S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1340	01.0	25.0	04.8	063.1	10850	-	-	-	-	-	-
09/23/69	1950	-	25.0	05.8	-	10880	-	-	-	-	-	-
09/24/69	0740	01.0	23.0	05.0	061.8	08230	-	-	-	-	-	-
09/24/69	1345	01.0	25.0	03.0	040.5	13550	-	-	-	-	-	-
09/24/69	1855	-	25.0	04.3	-	13650	-	-	-	-	-	-
09/25/69	0135	-	22.0	06.6	-	12000	-	-	-	-	-	-
09/25.69	0715	01.0	23.8	05.5	071.6	11960	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E04M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1950	-	25.0	-	-	-	-	-	-	-	-	-
09/25/69	0715	03.0	23.5	05.9	075.7	11010	-	-	-	-	-	-
09/25/69	1445	-	25.0	04.0	-	14600	-	-	-	-	-	-

STATION NO. E04B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0735	05.0	23.5	01.7	021.5	09720	-	-	-	-	-	-
09/23/69	1340	05.0	24.5	04.7	059.0	07080	-	-	-	-	-	-
09/23/69	1950	-	25.0	03.9	-	10390	-	-	-	-	-	-
09/24/69	0740	05.0	23.0	04.3	055.2	11970	-	-	-	-	-	-
09/24/69	1345	05.0	24.8	03.4	045.7	13450	-	-	-	-	-	-
09/24/69	1855	-	23.0	01.2	-	14000	-	-	-	-	-	-
09/25/69	0135	-	23.0	05.8	-	13100	-	-	-	-	-	-
09/25/69	0715	05.0	23.5	05.7	073.6	11710	-	-	-	-	-	-
09/25/69	1445	-	25.0	03.7	-	14700	-	-	-	-	-	-

STATION NO. E05S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	2200	-	24.0	05.4	-	05620	-	-	-	-	-	-
09/24/69	1910	-	24.0	06.1	-	05050	-	-	-	-	-	-
09/25/69	0155	-	22.0	05.0	-	03600	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E05M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0745	01.5	23.5	05.1	062.7	04700	0.39	.14	.094	0.070	0.029	03
09/23/69	1400	01.5	25.0	04.6	055.0	10460	-	-	-	-	-	-
09/24/69	0755	01.5	23.0	03.6	043.8	06680	-	-	-	-	-	-
09/24/69	1355	01.5	25.0	05.7	071.5	06000	-	-	-	-	-	-
09/25/69	0155	-	23.0	06.2	-	08900	-	-	-	-	-	-
09/25/69	0730	01.5	23.0	04.7	058.1	08240	-	-	-	-	-	-
09/25/69	1510	-	24.0	07.5	-	11400	-	-	-	-	-	-

STATION NO. E05B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	2200	-	24.0	04.8	-	06870	-	-	-	-	-	-
09/24/69	1910	-	25.0	04.4	-	11700	-	-	-	-	-	-
09/25/69	0155	-	23.0	03.3	-	12800	-	-	-	-	-	-

STATION NO. E06S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0800	01.0	23.5	02.9	035.8	07350	-	-	-	-	-	-
09/23/69	1410	01.0	24.5	06.4	081.9	08940	-	-	-	-	-	-
09/23/69	2220	-	25.0	06.3	-	-	-	-	-	-	-	-
09/24/69	0810	01.0	23.0	05.6	-	-	-	-	-	-	-	-
09/24/69	1400	01.0	25.5	09.3	123.4	10900	-	-	-	-	-	-
09/24/69	1920	-	24.0	07.4	-	07350	-	-	-	-	-	-
09/25/69	0200	-	21.0	05.8	-	04500	-	-	-	-	-	-
09/25/69	0740	01.0	23.5	06.4	081.3	10100	-	-	-	-	-	-
09/25/69	1515	-	27.0	10.2	-	03100	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E06M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1410	03.0	24.5	07.0	089.9	09330	-	-	-	-	-	-
09/23/69	2220	-	25.0	05.6	-	-	-	-	-	-	-	-
09/24/69	0810	03.0	23.0	04.8	-	-	-	-	-	-	-	-
09/24/69	1400	03.0	25.2	09.4	125.0	11600	-	-	-	-	-	-
09/24/69	1920	-	24.0	07.7	-	11600	-	-	-	-	-	-
09/25/69	0200	-	23.0	06.9	-	12200	-	-	-	-	-	-
09/25/69	0740	03.0	23.5	06.4	081.9	10850	-	-	-	-	-	-
09/25/69	1515	-	25.0	04.5	-	11600	-	-	-	-	-	-

STATION NO. E06B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0800	05.0	23.5	02.9	037.1	10920	-	-	-	-	-	-
09/23/69	1410	05.0	24.5	03.5	046.0	11740	-	-	-	-	-	-
09/23/69	2220	-	25.0	04.2	-	10980	-	-	-	-	-	-
09/24/69	0810	05.0	23.5	01.8	023.7	13820	-	-	-	-	-	-
09/24/69	1920	-	24.0	03.0	-	14200	-	-	-	-	-	-
09/25/69	0200	-	24.0	06.0	-	11900	-	-	-	-	-	-
09/25/69	0740	05.0	23.0	04.9	062.1	10840	-	-	-	-	-	-
09/25/69	1515	-	25.0	02.1	-	14700	-	-	-	-	-	-

STATION NO. E07S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0815	01.0	23.5	05.3	066.2	08430	2.59	.50	.169	0.467	0.315	05
09/23/69	1420	01.0	25.0	09.4	122.3	09730	-	-	-	-	-	-
09/23/69	1940	-	25.0	07.2	-	09510	-	-	-	-	-	-
09/24/69	0825	01.0	22.0	06.5	080.8	10580	2.55	.00	.165	0.348	0.232	03
09/24/69	1410	01.0	25.2	07.8	105.1	12900	-	-	-	-	-	-
09/24/69	1850	-	25.0	07.3	-	12650	-	-	-	-	-	-
09/25/69	0115	-	23.0	05.9	-	07000	-	-	-	-	-	-
09/25/69	0800	01.0	23.5	06.1	078.2	11000	0.56	.29	.143	0.060	0.020	06
09/25/69	1450	-	27.0	08.2	-	12900	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E07M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0815	03.0	23.5	05.5	069.6	09660	1.27	.80	.055	0.200	0.117	05
09/23/69	1420	03.0	25.0	06.4	083.3	09880	-	-	-	-	-	-
09/23/69	1940	-	25.0	08.7	-	10710	-	-	-	-	-	-
09/24/69	0825	03.0	22.5	06.0	075.2	10580	2.18	.45	.144	0.260	0.197	03
09/24/69	1410	03.0	25.0	07.5	100.7	12900	-	-	-	-	-	-
09/24/69	1850	-	25.0	07.6	-	13350	-	-	-	-	-	-
09/25/69	1450	-	26.0	04.6	-	14300	-	-	-	-	-	-

STATION NO. E07B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0815	05.0	23.5	03.3	042.3	11090	0.55	.32	.073	0.140	0.063	04
09/23/69	1420	05.0	24.5	05.9	077.4	11500	-	-	-	-	-	-
09/23/69	1940	-	25.0	03.7	-	12200	-	-	-	-	-	-
09/24/69	0825	05.0	23.5	01.3	017.0	13380	0.84	.45	.129	0.134	0.106	03
09/24/69	1410	05.0	24.8	06.6	089.0	13650	-	-	-	-	-	-
09/24/69	1850	-	24.0	04.6	-	13700	-	-	-	-	-	-
09/25/69	0115	-	24.0	06.6	-	11300	-	-	-	-	-	-
09/25/69	0800	05.0	23.5	01.0	013.2	14300	0.58	.41	.074	0.070	0.024	04
09/25/69	1450	-	25.0	05.3	-	14300	-	-	-	-	-	-

STATION NO. E08S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0835	01.0	23.5	06.3	078.9	08630	0.36	.14	.067	0.091	0.036	04
09/23/69	1430	01.0	24.8	06.5	083.5	08870	-	-	-	-	-	-
09/23/69	2100	-	25.0	09.2	-	09020	-	-	-	-	-	-
09/24/69	0835	01.0	22.0	07.7	093.6	08320	0.29	.06	.080	0.080	0.014	03
09/24/69	1430	01.0	24.5	10.3	130.8	08200	-	-	-	-	-	-
09/24/69	1820	-	25.0	11.8	-	08100	-	-	-	-	-	-
09/25/69	0015	-	24.0	07.5	-	07200	-	-	-	-	-	-
09/25/69	0845	01.0	23.5	08.8	110.0	08410	0.88	.06	.025	0.051	0.010	09
09/25/69	1410	-	27.0	09.2	-	07800	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E08M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0835	03.0	23.5	06.1	076.5	08750	0.38	.14	.054	0.082	0.024	04
09/23/69	1430	03.0	24.5	06.6	084.6	09180	-	-	-	-	-	-
09/23/69	2100	-	25.0	07.2	-	10590	-	-	-	-	-	-
09/24/69	0835	03.0	22.5	06.7	082.7	09000	0.31	.10	.071	0.066	0.015	03
09/24/69	1430	03.0	24.5	09.3	117.8	07900	-	-	-	-	-	-
09/24/69	1820	-	27.0	11.9	-	08300	-	-	-	-	-	-
09/25/69	0015	-	24.0	07.4	-	08900	-	-	-	-	-	-
09/25/69	0845	03.0	23.5	09.2	115.2	08580	0.43	.04	.052	0.030	0.007	17

STATION NO. E08B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0835	05.0	23.5	02.6	033.2	10760	0.51	.34	.017	0.176	0.113	04
09/23/69	1430	05.0	24.0	02.6	033.4	10330	-	-	-	-	-	-
09/23/69	2100	-	25.0	06.5	-	10510	-	-	-	-	-	-
09/24/69	0835	05.0	23.0	02.3	029.2	11120	0.34	.13	.055	0.070	0.020	03
09/24/69	1430	05.0	24.5	08.8	113.0	09300	-	-	-	-	-	-
09/24/69	1820	-	26.0	10.2	-	08600	-	-	-	-	-	-
09/25/69	0015	-	24.0	06.8	-	07550	-	-	-	-	-	-
09/25/69	0845	05.0	24.0	05.1	065.9	10930	0.35	.10	.037	0.056	0.014	06
09/25/69	1410	-	25.0	05.6	-	11900	-	-	-	-	-	-

STATION NO. E09S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1440	01.0	25.5	11.4	144.7	06320	-	-	-	-	-	-
09/23/69	2035	-	25.0	06.4	-	06940	-	-	-	-	-	-
09/24/69	0850	01.0	22.5	05.3	063.6	06030	0.36	.16	.124	0.050	0.022	03
09/24/69	1440	01.0	25.2	06.5	081.1	05050	-	-	-	-	-	-
09/25/69	0215	-	23.0	06.3	-	06000	-	-	-	-	-	-
09/25/69	0815	01.0	22.5	05.0	059.7	05590	0.22	.08	.135	0.029	0.010	07
09/25/69	1520	-	27.0	07.0	-	04000	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E09M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	2035	-	25.0	06.4	-	09280	-	-	-	-	-	-
09/24/69	0420	-	23.0	05.0	-	08200	-	-	-	-	-	-
09/25/69	0815	03.0	23.0	05.1	061.7	06070	0.39	.12	.145	0.088	0.075	07
09/25/69	1520	-	25.0	04.2	-	10500	-	-	-	-	-	-

STATION NO. E09B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0850	04.0	23.5	01.8	023.5	12980	-	-	-	-	-	-
09/23/69	2035	-	25.0	06.5	-	08790	-	-	-	-	-	-
09/24/69	0850	04.0	23.0	03.3	041.7	10440	-	-	-	-	-	-
09/24/69	1440	04.0	25.0	08.1	101.9	06300	0.31	.10	.058	0.049	0.026	03
09/24/69	1835	-	26.0	05.8	-	09000	-	-	-	-	-	-
09/25/69	0215	-	23.0	06.3	-	07200	-	-	-	-	-	-
09/25/69	0815	05.0	23.5	03.2	041.1	11320	0.40	.13	.071	0.075	0.018	10
09/25/69	1520	-	25.0	04.5	-	08450	-	-	-	-	-	-

STATION NO. E10S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0900	01.0	23.5	06.9	085.8	07840	0.44	.19	.094	0.108	0.031	04
09/23/69	1445	01.0	25.0	07.1	091.2	08510	-	-	-	-	-	-
09/23/69	2020	-	25.0	06.4	-	08220	-	-	-	-	-	-
09/24/69	0400	-	22.0	05.2	-	07350	-	-	-	-	-	-
09/24/69	0905	01.0	23.0	06.4	078.8	07820	-	-	-	-	-	-
09/24/69	1450	01.0	25.2	09.7	126.6	09900	0.44	.25	.102	0.050	0.029	06
09/24/69	1940	-	25.0	07.7	-	06550	-	-	-	-	-	-
09/25/69	0050	-	22.0	05.9	-	04550	-	-	-	-	-	-
09/25/69	0820	01.0	23.0	06.6	081.3	07900	0.35	.16	.085	0.042	0.020	06
09/25/69	1430	-	27.0	10.7	-	09250	-	-	-	-	-	-

APPENDIX II
SUMMARY UF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E10M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0900	04.5	23.5	06.6	082.5	08440	0.48	.18	.091	0.136	0.029	04
09/23/69	1445	04.5	24.5	07.4	095.1	09450	-	-	-	-	-	-
09/23/69	2020	-	25.0	06.6	-	08700	-	-	-	-	-	-
09/24/69	0905	04.5	23.0	06.0	074.8	09140	0.38	.09	.093	0.035	0.022	04
09/24/69	1450	04.5	25.0	08.5	112.2	11200	-	-	-	-	-	-
09/24/69	1840	-	25.0	09.4	-	08600	-	-	-	-	-	-
09/25/69	0050	-	24.0	07.5	-	09300	-	-	-	-	-	-
09/25/69	0820	04.0	23.5	07.0	088.9	10020	0.50	.17	.121	0.050	0.020	06

STATION NO. E10B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0900	08.0	23.5	02.9	038.0	13150	0.40	.17	.022	0.089	0.035	03
09/23/69	1445	08.0	24.5	03.6	047.7	12520	-	-	-	-	-	-
09/23/69	2020	-	25.0	04.4	-	13040	-	-	-	-	-	-
09/24/69	0905	08.0	23.5	03.1	041.0	14020	0.32	.12	.024	0.051	0.029	03
09/24/69	1450	08.0	24.6	05.6	075.4	13900	-	-	-	-	-	-
09/24/69	1840	-	25.0	03.1	-	15600	-	-	-	-	-	-
09/25/69	0050	-	24.0	04.9	-	11750	-	-	-	-	-	-
09/25/69	0820	07.0	23.7	03.2	042.7	14560	0.30	.01	<.005	0.394	0.010	09
09/25/69	1430	-	25.0	03.2	-	13900	-	-	-	-	-	-

STATION NO. E11S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1500	01.0	25.2	07.7	100.2	09400	-	-	-	-	-	-
09/23/69	2010	-	25.0	08.4	-	10160	-	-	-	-	-	-
09/24/69	0920	01.0	22.5	05.5	068.4	09740	-	-	-	-	-	-
09/24/69	.500	01.0	25.4	08.7	117.1	12500	-	-	-	-	-	-
09/24/69	1845	-	25.0	10.1	-	11950	-	-	-	-	-	-
09/25/69	0100	-	22.0	05.6	-	04600	-	-	-	-	-	-
09/25/69	0830	01.0	23.5	05.6	072.4	11860	-	-	-	-	-	-
09/25/69	1440	-	27.0	10.0	-	11300	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E11M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0910	03.0	23.5	04.7	059.2	09260	-	-	-	-	-	-
09/23/69	1500	03.0	25.0	07.1	092.0	09330	-	-	-	-	-	-
09/23/69	2010	-	25.0	-	-	-	-	-	-	-	-	-
09/24/69	0410	-	22.0	06.0	-	05310	-	-	-	-	-	-
09/24/69	0920	03.0	22.5	04.3	053.7	10130	-	-	-	-	-	-
09/24/69	1500	03.0	25.2	07.9	106.1	12600	-	-	-	-	-	-
09/25/69	0830	03.0	23.5	05.3	068.3	11490	-	-	-	-	-	-

STATION NO. E11B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0910	05.0	23.5	02.0	025.7	11530	-	-	-	-	-	-
09/23/69	1500	05.0	24.8	04.2	053.5	08030	-	-	-	-	-	-
09/23/69	2010	-	25.0	08.3	-	09890	-	-	-	-	-	-
09/24/69	0920	05.0	23.5	03.0	038.9	12250	-	-	-	-	-	-
09/24/69	1500	05.0	25.2	07.5	101.2	13100	-	-	-	-	-	-
09/24/69	1845	-	24.0	05.6	-	13900	-	-	-	-	-	-
09/25/69	0100	-	23.0	06.3	-	07850	-	-	-	-	-	-
09/25/69	0830	05.0	23.3	04.5	057.7	11360	-	-	-	-	-	-
09/25/69	1440	-	24.0	04.6	-	13700	-	-	-	-	-	-

STATION NO. E12S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	01.0	24.0	07.1	088.9	07720	-	-	-	-	-	-
09/23/69	1510	01.0	25.0	07.3	093.1	07760	-	-	-	-	-	-
09/23/69	2110	-	25.0	08.0	-	08370	-	-	-	-	-	-
09/24/69	0935	01.0	23.0	06.9	084.9	07780	-	-	-	-	-	-
09/24/69	1515	01.0	25.0	10.3	132.4	08500	-	-	-	-	-	-
09/24/69	1815	-	25.0	08.8	-	07850	-	-	-	-	-	-
09/25/69	0010	-	23.0	05.9	-	05300	-	-	-	-	-	-
09/25/69	0850	-	23.3	06.2	-	08120	-	-	-	-	-	-
09/25/69	1405	-	27.0	08.3	-	06450	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E12M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	03.5	24.0	06.4	080.7	08340	-	-	-	-	-	-
09/23/69	1510	03.5	24.8	07.6	098.5	09720	-	-	-	-	-	-
09/23/69	2110	-	25.0	-	-	08600	-	-	-	-	-	-
09/24/69	0935	03.5	23.0	04.8	059.9	09140	-	-	-	-	-	-
09/24/69	1515	03.5	25.0	10.7	137.4	08400	-	-	-	-	-	-
09/24/69	1815	-	25.0	08.5	-	07900	-	-	-	-	-	-

STATION NO. E12B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	06.0	24.0	01.7	022.3	12640	-	-	-	-	-	-
09/23/69	1510	06.0	24.5	04.3	054.7	08460	-	-	-	-	-	-
09/23/69	2110	-	25.0	07.9	-	08530	-	-	-	-	-	-
09/24/69	0935	06.0	24.0	00.9	012.0	14190	-	-	-	-	-	-
09/24/69	1515	06.0	24.8	10.1	129.8	08900	-	-	-	-	-	-
09/24/69	1815	-	25.0	08.6	-	07900	-	-	-	-	-	-
09/25/69	0010	-	24.0	06.2	-	08700	-	-	-	-	-	-
09/25/69	0850	-	23.8	04.0	-	12310	-	-	-	-	-	-

STATION NO. E13S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	01.0	24.0	06.6	081.5	06270	0.40	.17	.102	0.066	0.028	04
09/23/69	1525	01.0	24.5	05.2	066.2	08440	-	-	-	-	-	-
09/23/69	2120	-	25.0	06.4	-	08560	-	-	-	-	-	-
09/24/69	0315	-	24.0	05.7	-	08870	-	-	-	-	-	-
09/24/69	0950	01.0	23.5	06.9	085.5	07550	0.28	.11	.093	0.062	0.022	03
09/24/69	1520	01.0	24.8	09.6	-	-	-	-	-	-	-	-
09/24/69	1805	-	26.0	08.5	-	08250	-	-	-	-	-	-
09/25/69	0005	-	24.0	08.1	-	07150	-	-	-	-	-	-
09/25/69	0910	-	23.8	05.7	-	08540	0.49	.05	.074	0.052	0.010	06
09/25/69	1400	-	27.0	10.0	-	07400	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E13M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	04.0	24.0	05.7	071.4	07740	0.44	.13	.086	0.077	0.026	05
09/23/69	1525	04.0	24.5	06.3	080.6	09020	-	-	-	-	-	-
09/23/69	2120	-	25.0	07.2	-	-	-	-	-	-	-	-
09/24/69	0315	-	23.0	04.4	-	09390	-	-	-	-	-	-
09/24/69	0950	04.0	23.5	06.6	081.8	07590	0.35	.11	.096	0.058	0.029	03
09/24/69	1520	04.0	24.8	08.9	113.4	08000	-	-	-	-	-	-
09/24/69	1805	-	25.0	06.9	-	09450	-	-	-	-	-	-
09/25/69	0005	-	25.0	08.3	-	07500	-	-	-	-	-	-
09/25/69	0910	-	23.6	05.2	-	08940	0.36	.14	.077	0.058	0.024	05

STATION NO. E13B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	07.0	24.0	02.8	037.4	14120	0.38	.18	.016	0.073	0.039	03
09/23/69	1525	07.0	24.5	02.6	034.9	13780	-	-	-	-	-	-
09/23/69	2120	-	25.0	06.1	-	10990	-	-	-	-	-	-
09/24/69	0315	-	23.0	03.1	-	17390	-	-	-	-	-	-
09/24/69	0950	07.0	24.0	02.0	025.4	09210	0.38	.20	.023	0.096	0.070	03
09/24/69	1520	07.0	24.8	05.5	-	-	-	-	-	-	-	-
09/24/69	1805	-	25.0	03.2	-	12750	-	-	-	-	-	-
09/25/69	0005	-	24.0	03.2	-	13900	-	-	-	-	-	-
09/25/69	0910	-	24.0	02.1	-	13520	0.28	.14	.025	0.030	0.012	04
09/25/69	1400	-	25.0	02.6	-	13900	-	-	-	-	-	-

STATION NO. E14S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1000	01.0	24.0	07.0	087.0	06920	-	-	-	-	-	-
09/23/69	1620	01.0	25.0	05.6	070.9	07060	-	-	-	-	-	-
09/23/69	2125	-	25.0	06.4	-	08600	-	-	-	-	-	-
09/24/69	0320	-	22.0	05.5	-	11500	-	-	-	-	-	-
09/24/69	1000	01.0	23.5	-	-	-	-	-	-	-	-	-
09/24/69	1530	01.0	25.4	09.6	122.2	06800	-	-	-	-	-	-
09/24/69	1825	-	24.0	06.2	-	06300	-	-	-	-	-	-
09/25/69	0915	-	24.0	08.3	-	09310	-	-	-	-	-	-
09/25/69	1415	-	28.0	06.3	-	03400	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E14M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1000	04.5	24.0	05.8	075.8	12030	-	-	-	-	-	-
09/23/69	1620	04.5	25.0	09.1	115.4	07130	-	-	-	-	-	-
09/23/69	2125	-	24.0	06.5	-	09470	-	-	-	-	-	-
09/24/69	0320	-	23.0	05.5	-	18100	-	-	-	-	-	-
09/24/69	1000	04.5	23.5	-	-	-	-	-	-	-	-	-
09/24/69	1530	04.0	25.1	09.6	122.9	07900	-	-	-	-	-	-
09/24/69	1825	-	24.0	08.3	-	09000	-	-	-	-	-	-
09/25/69	0020	-	24.0	06.6	-	08000	-	-	-	-	-	-
09/25/69	0915	-	24.5	07.0	-	11550	-	-	-	-	-	-
09/25/69	1415	-	25.0	10.9	-	08400	-	-	-	-	-	-

STATION NO. E14B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	1000	08.0	24.0	03.1	041.6	14560	-	-	-	-	-	-
09/23/69	1620	08.0	24.5	04.0	053.6	13580	-	-	-	-	-	-
09/23/69	2125	-	25.0	04.6	-	13300	-	-	-	-	-	-
09/24/69	0320	-	23.0	03.2	-	20580	-	-	-	-	-	-
09/24/69	1000	08.0	24.0	03.8	050.9	14440	-	-	-	-	-	-
09/24/69	1530	08.0	24.8	07.6	100.9	12150	-	-	-	-	-	-
09/24/69	1825	-	24.0	05.9	-	13100	-	-	-	-	-	-
09/25/69	0020	-	24.0	06.2	-	09800	-	-	-	-	-	-
09/25/69	0915	-	24.0	02.6	-	15590	-	-	-	-	-	-
09/25/69	1415	-	25.0	08.8	-	10800	-	-	-	-	-	-

STATION NO. E15S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0700	01.0	23.0	08.2	101.1	07880	-	-	-	-	-	-
09/23/69	1615	01.0	25.0	06.1	078.7	08960	-	-	-	-	-	-
09/23/69	2150	-	25.0	05.7	-	10000	-	-	-	-	-	-
09/24/69	0335	-	22.0	05.5	-	09530	-	-	-	-	-	-
09/24/69	1000	01.0	23.5	06.7	084.1	08800	-	-	-	-	-	-
09/24/69	1540	01.0	25.0	09.8	129.6	11400	-	-	-	-	-	-
09/24/69	1830	-	27.0	10.1	-	11000	-	-	-	-	-	-
09/25/69	0030	-	23.0	06.1	-	05100	-	-	-	-	-	-
09/25/69	0905	01.0	24.0	06.4	080.6	08310	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E15S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/25/69	1420	-	28.0	10.3	-	09000	-	-	-	-	-	-

STATION NO. E15M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0700	05.0	23.0	06.1	079.6	13600	-	-	-	-	-	-
09/23/69	1615	03.5	25.0	07.0	090.3	08920	-	-	-	-	-	-
09/23/69	2150	-	25.0	04.5	-	-	-	-	-	-	-	-
09/24/69	1000	04.0	24.0	05.1	065.7	10580	-	-	-	-	-	-
09/24/69	1540	03.5	25.0	09.7	128.3	11400	-	-	-	-	-	-
09/24/69	1830	-	25.0	09.8	-	11500	-	-	-	-	-	-
09/25/69	0030	-	24.0	06.4	-	09900	-	-	-	-	-	-
09/25/69	0905	03.5	24.5	05.4	071.1	11910	-	-	-	-	-	-
09/25/69	1420	-	25.0	05.7	-	11400	-	-	-	-	-	-

STATION NO. E15B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0700	09.0	24.0	03.1	038.9	07960	-	-	-	-	-	-
09/23/69	1615	06.0	24.5	01.9	025.4	13620	-	-	-	-	-	-
09/23/69	2150	-	24.0	05.8	-	11200	-	-	-	-	-	-
09/24/69	1000	07.0	25.0	02.2	030.2	15150	-	-	-	-	-	-
09/24/69	1540	06.0	24.5	07.5	101.7	14700	-	-	-	-	-	-
09/24/69	1830	-	24.0	04.6	-	14800	-	-	-	-	-	-
09/25/69	0030	-	23.0	04.3	-	12900	-	-	-	-	-	-
09/25/69	0905	06.0	25.0	02.5	034.7	16240	-	-	-	-	-	-
09/25/69	1420	-	25.0	05.6	-	13500	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E16S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0740	01.0	24.0	06.4	079.5	06790	-	-	-	-	-	-
09/23/69	1550	01.0	25.5	10.1	129.0	06940	-	-	-	-	-	-
09/23/69	1945	-	24.0	09.1	-	07860	-	-	-	-	-	-
09/24/69	0005	-	23.0	06.7	-	07700	-	-	-	-	-	-
09/24/69	0915	01.0	23.5	07.3	091.7	08870	-	-	-	-	-	-
09/24/69	1520	01.0	26.0	07.3	-	-	-	-	-	-	-	-
09/24/69	1752	-	25.5	10.5	-	06800	-	-	-	-	-	-
09/24/69	2350	-	24.5	07.5	-	07700	-	-	-	-	-	-
09/25/69	0845	01.0	24.5	07.2	092.0	08880	-	-	-	-	-	-
09/25/69	1520	01.0	26.0	09.7	124.9	06900	-	-	-	-	-	-

STATION NO. E16M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0740	04.5	24.0	06.4	080.0	07450	-	-	-	-	-	-
09/23/69	1550	03.0	25.0	09.6	121.7	07060	-	-	-	-	-	-
09/23/69	1945	-	24.0	07.9	-	09210	-	-	-	-	-	-
09/24/69	0005	-	23.0	06.6	-	07670	-	-	-	-	-	-
09/24/69	0915	03.0	24.5	06.9	088.2	08870	-	-	-	-	-	-
09/24/69	1520	03.0	25.5	09.5	121.5	07100	-	-	-	-	-	-
09/24/69	1752	-	25.5	09.7	-	07150	-	-	-	-	-	-
09/24/69	2350	-	25.0	05.4	-	10850	-	-	-	-	-	-

STATION NO. E16B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0740	08.0	25.0	03.3	044.4	13230	-	-	-	-	-	-
09/23/69	1550	05.0	25.0	03.1	041.8	13310	-	-	-	-	-	-
09/23/69	1945	-	24.0	06.2	-	10140	-	-	-	-	-	-
09/24/69	0005	-	23.5	04.9	-	09500	-	-	-	-	-	-
09/24/69	0915	05.0	25.0	03.5	047.4	13910	-	-	-	-	-	-
09/24/69	1752	-	25.0	02.6	-	14900	-	-	-	-	-	-
09/24/69	2350	-	25.0	02.6	-	12350	-	-	-	-	-	-
09/25/69	0845	05.0	25.0	02.0	027.6	15620	-	-	-	-	-	-
09/25/69	1520	05.0	25.5	01.6	022.0	14650	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E17S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0730	01.0	23.5	06.4	078.9	07040	-	-	-	-	-	-
09/23/69	1600	01.0	25.0	08.2	103.5	06610	-	-	-	-	-	-
09/23/69	1940	-	24.0	07.3	-	07230	-	-	-	-	-	-
09/24/69	0015	-	23.5	06.1	-	08080	-	-	-	-	-	-
09/24/69	0920	01.0	24.5	06.5	082.5	08150	-	-	-	-	-	-
09/24/69	1540	01.0	27.0	09.2	120.4	06800	-	-	-	-	-	-
09/24/69	1748	-	25.5	09.6	-	08300	-	-	-	-	-	-
09/24/69	2355	-	25.0	09.0	-	08850	-	-	-	-	-	-
09/25/69	0850	01.0	23.5	06.8	084.5	07810	-	-	-	-	-	-
09/25/69	1530	01.0	27.0	13.8	181.5	07300	-	-	-	-	-	-

STATION NO. E17M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0730	05.0	23.5	06.5	080.8	07860	-	-	-	-	-	-
09/23/69	1600	03.0	25.0	08.6	109.7	07760	-	-	-	-	-	-
09/23/69	1940	-	24.0	08.9	-	08030	-	-	-	-	-	-
09/24/69	0015	-	23.5	04.4	-	11130	-	-	-	-	-	-
09/24/69	0920	04.0	24.0	05.8	074.7	10580	-	-	-	-	-	-
09/24/69	1540	04.0	25.5	08.6	113.2	10050	-	-	-	-	-	-
09/24/69	1748	-	25.5	09.9	-	09600	-	-	-	-	-	-
09/24/69	2355	-	25.0	08.5	-	09100	-	-	-	-	-	-
09/25/69	0850	03.5	24.0	06.2	077.4	07350	-	-	-	-	-	-
09/25/69	1530	03.5	26.0	10.2	136.8	11050	-	-	-	-	-	-

STATION NO. E17B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0730	09.0	24.0	03.5	046.9	14490	-	-	-	-	-	-
09/23/69	1600	06.0	25.0	04.2	057.3	14580	-	-	-	-	-	-
09/23/69	1940	-	24.0	02.7	-	14350	-	-	-	-	-	-
09/24/69	0015	-	24.0	04.1	-	14030	-	-	-	-	-	-
09/24/69	1540	07.0	25.5	04.6	063.0	14100	-	-	-	-	-	-
09/24/69	1748	-	25.0	05.1	-	14950	-	-	-	-	-	-
09/25/69	0850	06.0	24.5	03.5	047.8	15510	-	-	-	-	-	-
09/25/69	1530	06.0	25.5	03.0	041.5	15000	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E18S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0715	01.0	24.0	06.6	083.0	08100	-	-	-	-	-	-
09/23/69	1610	01.0	25.5	11.0	142.5	08460	-	-	-	-	-	-
09/23/69	1955	-	24.C	07.3	-	-	-	-	-	-	-	-
09/24/69	0020	-	23.0	05.8	-	09260	-	-	-	-	-	-
09/24/69	0930	01.0	23.5	06.6	083.1	09140	0.73	.59	.129	0.068	0.025	04
09/24/69	1545	01.0	26.0	10.1	135.2	10900	-	-	-	-	-	-
09/24/69	1741	-	25.5	12.6	-	11900	-	-	-	-	-	-
09/25/69	0820	-	24.8	08.3	-	-	-	-	-	-	-	-
09/25/69	0855	01.0	24.5	07.5	097.6	10720	0.32	.06	.124	0.048	0.021	06
09/25/69	1540	01.0	27.0	11.8	160.3	10600	-	-	-	-	-	-

STATION NO. F18M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0715	04.5	24.0	06.6	083.0	08120	-	-	-	-	-	-
09/23/69	1610	03.0	25.0	06.5	085.9	11320	-	-	-	-	-	-
09/23/69	1955	-	24.0	07.1	-	-	-	-	-	-	-	-
09/24/69	0020	-	23.5	04.7	-	11980	-	-	-	-	-	-
09/24/69	0930	03.5	23.5	05.7	072.6	10390	0.57	.34	.124	0.069	0.019	04
09/24/69	1741	-	25.5	10.1	-	12000	-	-	-	-	-	-
09/25/69	0820	-	25.0	07.5	-	-	-	-	-	-	-	-

STATION NO. E18B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0715	08.0	24.0	03.2	042.2	13000	-	-	-	-	-	-
09/23/69	1610	05.0	25.0	05.6	074.7	12330	-	-	-	-	-	-
09/23/69	1955	-	24.0	06.8	-	09600	-	-	-	-	-	-
09/24/69	0020	-	24.0	03.7	-	14020	-	-	-	-	-	-
09/24/69	0930	06.0	24.5	03.3	044.6	14420	0.34	.04	.092	0.076	0.014	04
09/24/69	1545	05.0	25.0	05.3	072.0	14100	-	-	-	-	-	-
09/24/69	1741	-	25.0	04.9	-	13700	-	-	-	-	-	-
09/25/69	0820	-	25.0	03.7	-	-	-	-	-	-	-	-
09/25/69	0855	04.5	25.0	03.0	042.1	17150	0.32	.12	.029	0.033	0.021	03
09/25/69	1540	05.0	25.5	03.1	042.9	19000	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E19S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0955	01.0	24.0	07.3	092.3	08700	-	-	-	-	-	-
09/23/69	1520	01.0	25.0	09.9	125.3	06970	-	-	-	-	-	-
09/23/69	1925	-	24.0	07.1	-	09180	-	-	-	-	-	-
09/24/69	0035	-	23.0	07.6	-	07920	-	-	-	-	-	-
09/24/69	0850	01.0	23.5	07.3	092.3	09630	-	-	-	-	-	-
09/24/69	1455	01.0	25.0	09.4	119.8	07650	-	-	-	-	-	-
09/24/69	1758	-	25.5	09.4	-	07750	-	-	-	-	-	-
09/25/69	0010	-	25.0	09.7	-	08250	-	-	-	-	-	-
09/25/69	0820	01.0	24.5	06.8	086.7	08590	-	-	-	-	-	-
09/25/69	1510	01.0	28.0	09.9	130.4	05700	-	-	-	-	-	-

STATION NO. E19M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0955	04.0	24.5	06.9	088.1	08800	-	-	-	-	-	-
09/23/69	1925	-	24.0	07.3	-	09350	-	-	-	-	-	-
09/24/69	0035	-	23.0	05.5	-	07960	-	-	-	-	-	-
09/24/69	1758	-	25.5	09.6	-	07500	-	-	-	-	-	-
09/25/69	0010	-	25.0	09.4	-	08200	-	-	-	-	-	-

STATION NO. E19B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0955	07.0	25.0	03.8	051.3	13480	-	-	-	-	-	-
09/23/69	1520	04.0	25.5	05.5	073.0	10930	-	-	-	-	-	-
09/23/69	1925	-	24.0	05.6	-	10490	-	-	-	-	-	-
09/24/69	0035	-	23.5	03.5	-	11680	-	-	-	-	-	-
09/24/69	0850	04.0	24.0	03.3	044.1	14260	-	-	-	-	-	-
09/24/69	1455	04.0	25.0	08.4	108.7	09250	-	-	-	-	-	-
09/24/69	1758	-	25.0	05.8	-	13200	-	-	-	-	-	-
09/25/69	0010	-	25.0	04.9	-	13200	-	-	-	-	-	-
09/25/69	0820	04.0	25.5	02.0	028.2	16910	-	-	-	-	-	-
09/25/69	1510	04.0	25.5	03.4	047.0	15000	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E20S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0935	01.0	24.0	07.6	095.5	08080	0.47	.10	.098	0.062	0.013	04
09/23/69	1510	01.0	25.0	10.4	132.7	07760	-	-	-	-	-	-
09/23/69	1915	-	24.0	09.2	-	08000	-	-	-	-	-	-
09/24/69	0030	-	23.5	06.4	-	09190	-	-	-	-	-	-
09/24/69	0840	01.0	23.5	07.6	095.7	09120	0.41	.24	.097	0.138	0.017	04
09/24/69	1445	01.0	25.0	10.0	-	-	-	-	-	-	-	-
09/24/69	1802	-	25.8	09.5	-	07900	-	-	-	-	-	-
09/25/69	0015	-	25.0	08.1	-	08800	-	-	-	-	-	-
09/25/69	0810	01.0	24.0	06.8	086.1	08870	0.32	.07	.129	0.050	0.018	05
09/25/69	1500	01.0	28.0	11.0	146.9	07150	-	-	-	-	-	-

STATION NO. E20M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0935	06.5	24.5	06.5	085.3	11500	0.29	.08	.055	0.061	0.013	03
09/23/69	1510	06.5	25.5	06.5	087.6	12470	-	-	-	-	-	-
09/23/69	1915	-	24.0	05.2	-	13820	-	-	-	-	-	-
09/24/69	0030	-	23.5	05.4	-	12270	-	-	-	-	-	-
09/24/69	0840	05.0	24.0	05.5	071.8	11900	0.32	.16	.065	0.100	0.013	03
09/24/69	1802	-	25.4	06.1	-	13850	-	-	-	-	-	-
09/25/69	0015	-	25.0	06.8	-	09600	-	-	-	-	-	-
09/25/69	0810	04.0	24.5	05.8	074.3	09060	0.32	.08	.209	0.041	0.022	05
09/25/69	1500	05.0	26.0	07.9	108.4	13300	-	-	-	-	-	-

STATION NO. E20B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0935	12.0	25.0	06.2	084.9	14830	0.25	.11	.014	0.076	0.040	03
09/23/69	1510	12.0	25.0	03.2	043.9	15100	-	-	-	-	-	-
09/23/69	1915	-	24.0	04.4	-	14980	-	-	-	-	-	-
09/24/69	0030	-	24.0	03.8	-	15190	-	-	-	-	-	-
09/24/69	1445	09.0	25.0	04.0	-	-	-	-	-	-	-	-
09/24/69	1802	-	25.0	03.7	-	16100	-	-	-	-	-	-
09/25/69	0015	-	25.0	02.9	-	15750	-	-	-	-	-	-
09/25/69	0810	07.0	25.0	02.2	031.1	17840	0.38	.11	<.005	0.051	0.014	07
09/25/69	1500	09.0	25.5	02.1	029.3	15750	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E21S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	01.0	24.0	07.5	094.6	08390	-	-	-	-	-	-
09/23/69	1500	01.0	25.5	10.1	131.5	08970	-	-	-	-	-	-
09/23/69	1910	-	24.0	08.4	-	09080	-	-	-	-	-	-
09/24/69	0830	01.0	23.5	05.8	073.1	09340	-	-	-	-	-	-
09/24/69	1435	01.0	25.0	09.6	125.2	10000	-	-	-	-	-	-
09/24/69	1806	-	25.8	10.6	-	10550	-	-	-	-	-	-
09/25/69	0020	-	25.0	07.5	-	09400	-	-	-	-	-	-
09/25/69	0805	01.0	23.5	06.6	082.9	08890	-	-	-	-	-	-
09/25/69	1450	01.0	27.5	12.0	162.6	09500	-	-	-	-	-	-

STATION NO. E21M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	04.5	24.0	07.6	096.6	09160	-	-	-	-	-	-
09/23/69	1500	04.5	25.5	07.7	101.4	10160	-	-	-	-	-	-
09/23/69	1910	-	24.0	07.4	-	10820	-	-	-	-	-	-
09/24/69	0040	-	23.0	05.8	-	11200	-	-	-	-	-	-
09/24/69	1806	-	25.8	10.2	-	10800	-	-	-	-	-	-
09/25/69	0020	-	25.0	07.1	-	12850	-	-	-	-	-	-
09/25/69	0805	03.0	24.5	05.8	077.3	13120	-	-	-	-	-	-

STATION NO. E21B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0945	08.0	25.0	04.9	066.4	13820	-	-	-	-	-	-
09/23/69	1500	08.0	25.0	-	-	14500	-	-	-	-	-	-
09/23/69	1910	-	24.0	02.1	-	13520	-	-	-	-	-	-
09/24/69	0040	-	23.5	04.1	-	14480	-	-	-	-	-	-
09/24/69	0830	05.0	24.5	03.1	042.1	14880	-	-	-	-	-	0
09/24/69	1435	05.0	25.0	05.4	072.1	12350	-	-	-	-	-	-
09/24/69	1806	-	25.0	03.5	-	15400	-	-	-	-	-	-
09/25/69	0020	-	25.0	04.5	-	14950	-	-	-	-	-	-
09/25/69	0805	05.0	24.5	02.5	034.6	16840	-	-	-	-	-	-
09/25/69	1450	05.0	25.5	07.4	101.6	14200	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E22S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0915	01.0	23.5	07.8	098.5	09430	0.42	.03	.054	0.260	0.194	04
09/23/69	1540	01.0	25.5	09.9	126.8	07240	-	-	-	-	-	-
09/23/69	1855	-	24.0	08.3	-	08650	-	-	-	-	-	-
09/24/69	0110	-	23.0	07.7	-	09020	-	-	-	-	-	-
09/24/69	0820	01.0	24.0	07.7	099.0	10390	0.23	.07	.074	0.038	0.010	-
09/24/69	1505	01.0	25.5	10.0	129.9	08700	-	-	-	-	-	-
09/24/69	1820	-	25.3	09.0	-	08700	-	-	-	-	-	-
09/25/69	0042	-	24.8	08.9	-	08100	-	-	-	-	-	-
09/25/69	0830	01.0	24.0	07.9	099.9	08650	0.24	.05	.093	0.039	0.014	05
09/25/69	1515	01.0	26.0	11.2	145.5	07800	-	-	-	-	-	-

STATION NO. E22M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0915	05.0	24.0	07.6	096.9	09550	0.32	.04	.055	0.057	0.014	-
09/23/69	1540	03.0	25.5	09.5	122.7	08130	-	-	-	-	-	-
09/23/69	1855	-	24.0	07.3	-	11180	-	-	-	-	-	-
09/24/69	0110	-	23.0	07.8	-	08850	-	-	-	-	-	-
09/24/69	0820	03.0	24.0	07.3	094.3	10830	0.25	.04	.068	0.035	0.007	-
09/24/69	1505	03.0	25.5	09.9	128.3	08500	-	-	-	-	-	-
09/24/69	1820	-	25.2	05.3	-	13500	-	-	-	-	-	-
09/25/69	0042	-	25.0	04.0	-	14500	-	-	-	-	-	-
09/25/69	0830	03.0	24.0	07.9	100.2	08970	0.21	.02	.091	0.039	0.009	07

STATION NO. E22B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O PHOS MG/L	TOC MG/L
09/23/69	1540	06.0	25.0	03.9	053.1	14330	-	-	-	-	-	-
09/23/69	1855	-	24.0	04.0	-	14920	-	-	-	-	-	-
09/24/69	0820	06.0	24.5	03.9	052.9	14780	0.21	.15	.020	0.031	0.016	-
09/24/69	1505	06.0	25.0	04.9	067.0	14700	-	-	-	-	-	-
09/24/69	1820	-	25.2	03.5	-	15000	-	-	-	-	-	-
09/25/69	0042	-	25.0	03.3	-	15450	-	-	-	-	-	-
09/25/69	0830	05.0	24.5	02.4	032.9	15960	0.26	.03	.017	0.027	0.012	0
09/25/69	1515	05.0	26.0	07.1	097.1	13050	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E23S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0925	01.0	24.0	07.8	099.1	09180	-	-	-	-	-	-
09/23/69	1430	01.0	25.0	09.8	126.3	08800	-	-	-	-	-	-
09/23/69	1845	-	24.0	08.9	-	09310	-	-	-	-	-	-
09/24/69	0100	-	22.5	06.6	-	09730	-	-	-	-	-	-
09/24/69	0810	01.0	23.5	06.7	084.7	09550	-	-	-	-	-	-
09/24/69	1415	01.0	25.0	09.9	129.0	09900	-	-	-	-	-	-
09/24/69	1815	-	25.8	10.3	-	09000	-	-	-	-	-	-
09/25/69	0030	-	25.0	08.5	-	08300	-	-	-	-	-	-
09/25/69	0745	01.0	24.0	06.9	087.5	08950	-	-	-	-	-	-
09/25/69	1435	01.0	27.5	11.4	151.1	07250	-	-	-	-	-	-

STATION NO. E23M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0925	06.5	24.0	06.1	080.2	12620	-	-	-	-	-	-
09/23/69	1430	06.5	25.0	07.8	103.7	11940	-	-	-	-	-	-
09/24/69	0100	-	23.0	06.5	-	10000	-	-	-	-	-	-
09/24/69	0810	06.0	24.5	06.4	086.4	14320	-	-	-	-	-	-
09/24/69	1415	06.0	25.0	05.4	074.5	15500	-	-	-	-	-	-
09/24/69	1815	-	25.2	04.5	-	13700	-	-	-	-	-	-
09/25/69	0030	-	25.0	07.2	-	11600	-	-	-	-	-	-
09/25/69	0745	05.5	25.0	03.7	051.4	16270	-	-	-	-	-	-
09/25/69	1435	06.0	25.5	04.7	064.9	14750	-	-	-	-	-	-

STATION NO. E23B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0925	12.0	24.5	05.1	069.7	15500	-	-	-	-	-	-
09/23/69	1430	12.0	25.5	05.0	069.6	15650	-	-	-	-	-	-
09/23/69	1845	-	24.0	04.5	-	15310	-	-	-	-	-	-
09/24/69	0100	-	23.5	04.1	-	14980	-	-	-	-	-	-
09/24/69	0810	11.0	24.5	03.4	046.7	16000	-	-	-	-	-	-
09/24/69	1415	11.0	25.5	04.0	056.3	16600	-	-	-	-	-	-
09/24/69	1815	-	25.0	04.2	-	16400	-	-	-	-	-	-
09/25/69	0030	-	25.0	04.5	-	15400	-	-	-	-	-	-
09/25/69	0745	10.0	25.0	02.5	035.1	17390	-	-	-	-	-	-
09/25/69	1435	11.0	25.5	02.2	030.8	16100	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E24S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0900	01.0	23.5	07.4	093.4	09460	0.76	.33	.119	0.166	0.049	05
09/23/69	1445	01.0	25.0	10.4	134.2	08930	-	-	-	-	-	-
09/23/69	1905	-	24.0	08.1	-	09420	-	-	-	-	-	-
09/24/69	0045	-	23.0	09.7	-	11830	-	-	-	-	-	-
09/24/69	1425	01.0	25.0	09.7	126.6	10100	-	-	-	-	-	-
09/25/69	0025	-	25.0	08.1	-	09450	-	-	-	-	-	-
09/25/69	0755	01.0	24.0	07.3	094.7	11260	0.50	.14	.005	0.026	0.032	24
09/25/69	1445	01.0	26.0	12.6	169.1	11100	-	-	-	-	-	-

STATION NO. E24M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0900	05.0	24.0	05.9	076.4	11120	0.36	.02	.048	0.037	0.005	07
09/23/69	1445	05.0	25.0	07.7	103.8	13290	-	-	-	-	-	-
09/23/69	1905	-	24.0	06.2	-	14100	-	-	-	-	-	-
09/24/69	0045	-	23.0	05.4	-	11860	-	-	-	-	-	-
09/24/69	1425	04.0	25.0	06.2	083.5	13200	-	-	-	-	-	-
09/24/69	1810	-	25.2	07.7	-	14400	-	-	-	-	-	-
09/25/69	0025	-	25.0	07.2	-	11900	-	-	-	-	-	-
09/25/69	0755	03.0	25.0	07.0	095.8	14750	0.40	.03	.061	0.046	0.019	08
09/25/69	1445	04.0	25.5	09.0	122.6	13500	-	-	-	-	-	-

STATION NO. E24B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0900	09.0	24.5	04.0	054.4	15020	0.21	.08	.010	0.053	0.020	03
09/23/69	1445	09.0	25.0	05.1	069.9	14990	-	-	-	-	-	-
09/23/69	1905	-	24.0	04.6	-	14710	-	-	-	-	-	-
09/24/69	0045	-	23.5	04.7	-	13490	-	-	-	-	-	-
09/24/69	1425	07.0	25.0	03.6	050.4	17000	-	-	-	-	-	-
09/24/69	1810	-	24.9	03.6	-	16000	-	-	-	-	-	-
09/25/69	0025	-	25.0	05.8	-	15000	-	-	-	-	-	-
09/25/69	0755	05.0	25.0	07.2	100.7	16810	0.46	.08	.009	0.042	0.199	05
09/25/69	1445	07.0	25.5	03.2	044.8	16150	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E25S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0845	01.0	23.5	05.3	067.3	10000	-	-	-	-	-	-
09/23/69	1410	01.0	25.0	11.2	144.7	09060	-	-	-	-	-	-
09/23/69	1830	-	24.0	08.7	-	08630	-	-	-	-	-	-
09/24/69	0120	-	23.0	06.7	-	10720	-	-	-	-	-	-
09/24/69	0800	01.0	23.0	07.4	093.9	10850	-	-	-	-	-	-
09/24/69	1405	01.0	25.0	09.6	125.6	10350	-	-	-	-	-	-
09/24/69	1827	-	25.3	11.3	-	09000	-	-	-	-	-	-
09/25/69	0050	-	25.0	10.4	-	09150	-	-	-	-	-	-
09/25/69	0740	01.0	23.5	07.4	091.8	07680	-	-	-	-	-	-
09/25/69	1425	01.0	26.5	11.5	151.5	08350	-	-	-	-	-	-

STATION NO. E25M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0845	07.5	24.5	03.6	048.1	13320	-	-	-	-	-	-
09/23/69	1410	07.5	25.0	09.9	135.1	14500	-	-	-	-	-	-
09/23/69	1830	-	24.0	09.1	-	09330	-	-	-	-	-	-
09/24/69	0120	-	23.5	06.7	-	10840	-	-	-	-	-	-
09/24/69	0800	06.5	24.0	05.9	078.3	13500	-	-	-	-	-	-
09/24/69	1405	05.5	25.0	07.5	101.4	13600	-	-	-	-	-	-
09/25/69	0050	-	25.0	08.0	-	09550	-	-	-	-	-	-
09/25/69	0740	04.5	24.5	04.6	061.1	12690	-	-	-	-	-	-
09/25/69	1425	04.5	26.0	11.6	151.3	08250	-	-	-	-	-	-

STATION NO. E25B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0845	14.0	25.0	02.9	040.1	15910	-	-	-	-	-	-
09/23/69	1410	14.0	25.0	05.6	075.6	13480	-	-	-	-	-	-
09/23/69	1830	-	24.0	07.7	-	12390	-	-	-	-	-	-
09/24/69	0120	-	24.0	04.2	-	14720	-	-	-	-	-	-
09/24/69	0800	13.0	25.0	04.1	057.2	16660	-	-	-	-	-	-
09/24/69	1405	10.0	25.0	04.2	058.9	17100	-	-	-	-	-	-
09/24/69	1827	-	25.0	03.8	-	17000	-	-	-	-	-	-
09/25/69	0050	-	25.0	03.3	-	16150	-	-	-	-	-	-
09/25/69	0740	08.0	25.0	02.4	033.2	16000	-	-	-	-	-	-
09/25/69	1425	08.0	25.5	01.9	026.5	16050	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E26S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0830	01.0	23.5	06.1	078.7	11640	-	-	-	-	-	-
09/23/69	1330	01.0	25.0	10.2	134.6	11220	-	-	-	-	-	-
09/23/69	1837	-	24.0	06.3	-	08780	-	-	-	-	-	-
09/24/69	0125	-	23.0	07.3	-	11850	-	-	-	-	-	-
09/24/69	0750	01.0	23.5	08.6	116.9	16680	-	-	-	-	-	-
09/24/69	1355	01.0	25.0	09.9	130.9	11400	-	-	-	-	-	-
09/24/69	1832	-	25.2	11.8	-	10300	-	-	-	-	-	-
09/25/69	0057	-	25.0	08.6	-	11200	-	-	-	-	-	-
09/25/69	0730	01.0	24.0	08.0	101.7	09250	-	-	-	-	-	-
09/25/69	1420	01.0	26.5	12.3	164.2	09750	-	-	-	-	-	-

STATION NO. E26M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0830	07.0	24.0	07.4	098.6	13860	-	-	-	-	-	-
09/23/69	1837	-	24.0	06.0	-	11000	-	-	-	-	-	-
09/24/69	0125	-	23.5	08.1	-	12170	-	-	-	-	-	-
09/24/69	0750	05.0	24.0	06.5	087.4	14750	-	-	-	-	-	-
09/24/69	1355	05.0	25.0	04.2	059.1	17500	-	-	-	-	-	-
09/24/69	1832	-	25.0	10.4	-	12500	-	-	-	-	-	-
09/25/69	0057	-	25.0	08.2	-	-	-	-	-	-	-	-
09/25/69	0730	05.5	25.0	05.8	080.2	15800	-	-	-	-	-	-
09/25/69	1420	05.0	26.0	08.5	117.0	13650	-	-	-	-	-	-

STATION NO. E26B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0830	13.0	25.0	05.6	077.6	15920	-	-	-	-	-	-
09/23/69	1330	10.0	25.0	06.1	084.5	15960	-	-	-	-	-	-
09/24/69	0125	-	24.0	04.6	-	15610	-	-	-	-	-	-
09/24/69	0750	10.0	25.0	04.2	056.0	12300	-	-	-	-	-	-
09/24/69	1355	10.0	25.5	04.1	057.7	16600	-	-	-	-	-	-
09/24/69	1832	-	25.0	03.8	-	17500	-	-	-	-	-	-
09/25/69	0087	-	25.0	03.4	-	-	-	-	-	-	-	-
09/25/69	0730	10.0	25.0	02.6	036.7	17870	-	-	-	-	-	-
09/25/69	1420	09.0	26.0	03.3	046.8	16500	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E27S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0815	01.0	24.0	06.0	078.3	11810	1.08	.04	.036	0.075	0.019	05
09/23/69	1345	01.0	25.0	10.6	141.6	12420	-	-	-	-	-	-
09/23/69	1815	-	24.0	10.9	-	10000	-	-	-	-	-	-
09/24/69	0135	-	23.0	07.9	-	11980	-	-	-	-	-	-
09/24/69	0735	01.0	24.0	07.8	106.7	16380	0.22	.07	.007	0.037	0.020	-
09/24/69	1345	01.0	25.5	09.5	128.5	12800	-	-	-	-	-	-
09/24/69	1837	-	25.2	11.4	-	11000	-	-	-	-	-	-
09/25/69	0105	-	25.0	10.3	-	11750	-	-	-	-	-	-
09/25/69	0715	01.0	24.0	08.6	110.7	10450	0.19	.05	.067	0.034	0.018	04
09/25/69	1400	01.0	27.0	07.3	-	-	-	-	-	-	-	-
09/25/69	1410	01.0	26.0	11.9	160.8	11800	-	-	-	-	-	-

STATION NO. E27M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0815	07.5	25.0	04.5	061.6	14900	0.38	.13	<.005	0.030	0.008	03
09/23/69	1345	06.0	25.0	06.6	090.2	14610	-	-	-	-	-	-
09/23/69	1815	-	24.0	11.1	-	10280	-	-	-	-	-	-
09/24/69	0735	05.5	24.0	06.8	091.3	14600	0.26	.20	<.005	0.034	0.024	08
09/24/69	1345	06.0	25.5	07.6	105.9	15700	-	-	-	-	-	-
09/24/69	1837	-	25.2	05.9	-	12300	-	-	-	-	-	-
09/25/69	0105	-	25.0	09.2	-	13450	-	-	-	-	-	-
09/25/69	0715	06.0	25.0	07.9	108.0	14670	0.19	.03	.018	0.042	0.016	05
09/25/69	1400	06.0	25.5	05.1	-	-	-	-	-	-	-	-

STATION NO. E27B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0815	14.0	25.0	-	-	16000	0.74	.20	.021	0.247	0.199	03
09/23/69	1345	11.3	25.5	04.9	068.4	15890	-	-	-	-	-	-
09/23/69	1815	-	24.0	04.6	-	15290	-	-	-	-	-	-
09/24/69	0135	-	23.5	04.7	-	15720	-	-	-	-	-	-
09/24/69	0735	11.0	24.5	04.1	-	-	0.23	.14	<.005	0.030	0.016	06
09/24/69	1345	11.0	25.0	04.1	057.4	16900	-	-	-	-	-	-
09/24/69	1837	-	25.0	04.0	-	16900	-	-	-	-	-	-
09/25/69	0105	-	25.0	04.3	-	15800	-	-	-	-	-	-
09/25/69	0715	11.0	24.5	02.9	041.2	19120	0.29	.16	.007	0.060	0.028	02

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E27B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/25/69	1400	11.0	25.5	02.4	-	-	-	-	-	-	-	-
09/25/69	1410	11.0	25.5	03.1	043.7	16800	-	-	-	-	-	-

STATION NO. E28S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0800	01.0	23.5	07.8	100.9	11860	-	-	-	-	-	-
09/23/69	1310	01.0	25.0	10.4	139.2	12620	-	-	-	-	-	-
09/23/69	1800	-	24.0	09.0	-	11420	-	-	-	-	-	-
09/24/69	0725	01.0	23.5	07.9	103.3	12900	-	-	-	-	-	-
09/24/69	1330	01.0	25.0	06.2	084.0	13800	-	-	-	-	-	-
09/25/69	0110	-	25.0	11.7	-	10150	-	-	-	-	-	-
09/25/69	0700	01.0	24.0	09.2	118.6	10620	-	-	-	-	-	-

STATION NO. E28M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0800	07.5	24.5	07.4	100.1	14540	-	-	-	-	-	-
09/23/69	1310	07.5	25.0	09.8	131.9	13150	-	-	-	-	-	-
09/23/69	1800	-	24.0	08.2	-	13660	-	-	-	-	-	-
09/24/69	0725	06.5	24.0	07.7	102.3	13650	-	-	-	-	-	-
09/24/69	1330	05.0	25.0	05.3	072.7	15000	-	-	-	-	-	-
09/25/69	0110	-	25.0	05.3	-	12450	-	-	-	-	-	-
09/25/69	0700	06.5	24.5	07.4	100.6	15010	-	-	-	-	-	-

APPENDIX II
SUMMARY OF DATA
ESCAMBIA BAY - 9/23/69 TO 9/25/69

STATION NO. E288

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/23/69	0800	14.0	25.0	04.7	065.4	16320	-	-	-	-	-	-
09/23/69	1310	14.0	25.0	08.2	112.1	14680	-	-	-	-	-	-
09/23/69	1800	-	24.0	05.7	-	14960	-	-	-	-	-	-
09/24/69	0725	12.0	25.0	04.3	060.3	17100	-	-	-	-	-	-
09/24/69	1330	09.0	25.5	03.7	052.3	17000	-	-	-	-	-	-
09/25/69	0110	-	25.0	05.7	-	16300	-	-	-	-	-	-
09/25/69	0700	12.0	24.5	03.1	044.6	20400	-	-	-	-	-	-

APPENDIX IV

ESCAMBIA RIVER CHEMICAL DATA

STA.	DEPTH	DATE	TIME	TEMP °C	D.O. (mg/ℓ)	pH	BOD_5 (mg/ℓ)	TOC (mg/ℓ)	COLOR (units)
C-1	mid., 2 ft.	10/27	0930	19.5	8.2	7.3	2.0	--	70
C-2	mid., 2 ft.	10/27	1100	20.0	8.1	7.1	0.8	--	75
C-3		9/15	1610	26	9.4	7.6	--	--	--
		9/16	1610	26	9.0	7.7	--	--	--
		9/19	1300	--	--	--	--	3	--
	mid., 2 ft.	10/27	1200	20.0	7.8	7.0	2.0	--	120
BE-4		9/15	1500	24	9.8	7.2	--	--	--
		9/16	1530	24	9.7	7.3	--	--	--
		9/19	1000	--	--	--	--	1	--
	Left, 2 ft.	10/27	1400	19.5	8.2	7.4	1.2	--	40
	mid., 2 ft.	10/27	1400	19.0	--	7.4	0.6	--	40
	rt., 2 ft.	10/27	1400	19.0	8.1	7.3	0.2	--	40
E-5		9/17	1210	--	6.2	7.3	--	3	--
		9/17	1730	25	6.2	7.4	--	3	--
		9/18	1000	24	6.0	7.4	--	4	--
		9/19	1035	25	6.6	7.7	--	3	--
		9/19	1500	26	6.3	7.6	--	3	--
		9/20	2400	23	5.8	7.7	--	4	--
	Left, 2 ft.	10/27	1630	20.5	7.2	7.2	1.4	--	120
	mid., 2 ft.	10/27	1630	20.5	7.1	7.2	1.2	--	40
	rt., 2 ft.	10/27	1630	20.5	7.2	7.3	1.8	--	110
E-6		9/17	1305	--	6.8	7.2	0.7	3	--
		9/17	1820	25	6.5	7.5	2.0	3	--
		9/18	0815	23	6.6	7.5	0.6	3	--
		9/19	1000	24	7.1	7.8	2.8	3	--
		9/19	1520	26	6.4	7.2	2.0	3	--
		9/21	0100	24	6.5	7.5	1.7	3	--
	mid., 2 ft.	10/27	1120	19.0	7.5	--	0.6	--	80
	7 ft.	10/27	1120	--	7.5	--	--	--	--
E-7	mid., 2 ft.	10/27	1200	19.5	6.8	--	0.6	--	65
	4½ ft.	10/27	1200	--	7.1	--	--	--	--
	8½ ft.	10/27	1200	--	7.2	--	--	--	--
E-8	mid., 2 ft.	10/27	1230	20.0	6.9	7.3	0.6	--	70
	6½ ft.	10/27	1230	--	6.9	--	--	--	--
	13 ft.	10/27	1230	--	5.2	7.3	--	--	--

APPENDIX IV (Continued)

ESCAMBIA RIVER CHEMICAL DATA

STA.	DEPTH	DATE	TIME	TEMP °C	D.O. (mg/ℓ)	pH	BOD_5 (mg/ℓ)	TOC (mg/ℓ)	COLOR (units)
E-9	mid., 2 ft.	10/27	1300	24.0	7.1	7.0	3.3	--	85
	8 ft.	10/27	1300	--	6.8	--	--	--	--
	16 ft.	10/27	1300	--	1.5	--	--	--	--
E-10	mid., 2 ft.	10/27	--	21.5	6.1	7.5	1.0	--	80
	7 ft.	10/27	--	--	5.6	--	--	--	--
	8½ ft.	10/27	--	--	4.7	--	--	--	--
	10 ft.	10/27	--	--	4.5	--	--	--	--
	14 ft.	10/27	--	21.5	3.0	7.5	--	--	--
W-11	mid., 2 ft.	10/27	--	20.0	6.9	7.6	1.2	--	60
	7 ft.	10/27	--	--	6.9	--	--	--	--
	14 ft.	10/27	--	--	6.5	--	--	--	--
E-12	mid., 2 ft.	10/27	1430	21.5	6.3	6.7	1.2	--	65
	7 ft.	10/27	1430	--	5.0	--	--	--	--
	14 ft.	10/27	1430	--	3.2	--	--	--	--
E-13	mid., 2 ft.	10/27	1445	--	6.2	--	1.2	--	60
E-14	mid., 2 ft.	10/27	--	--	5.6	--	0.8	--	60

APPENDIX V

LIST OF SPECIES
QUALITATIVE SAMPLES
OCTOBER 22, 1969

	STATION				
	C-1	C-2	C-3	BE-4	E-5
Porifera					
Spongilla sp.			X		
Amphipoda					
Crangonyx sp.	X				
Decapoda					
Astacidae		X	X	X	
Paleomonetas sp.				X	
Plecoptera					
Pteronarcys sp.		X			
Acroneuria sp.		X	X		
Neoperla clymene	X	X	X		X
Paragnetina sp.				X	X
Ephemeroptera					
Hexagenia munda marilandica	X				
Stenonema smithae	X	X	X	X	
Stenonema exiguum	X	X	X		X
Heptagenia sp.	X				X
Isonychia sp. A		X		X	
Baetisca gibberi		X			
Ephemerella sp.		X			
Tricorythodes albilineatus			X		

APPENDIX V (Continued)

LIST OF SPECIES
QUALITATIVE SAMPLES
OCTOBER 22, 1969

	STATION				
	C-1	C-2	C-3	BE-4	E-5
Caenis sp.				X	
Callibaetis pretiosus				X	
Baetis sp.	X	X		X	
Centroptilum sp.					X
Centroptilum viridocularis			X		
Anisoptera					
Progomphus sp.		X			
Erpetogomphus sp.			X		
Boyeria vinosa	X	X	X	X	X
Macromia sp.	X				
Macromia taeniolata				X	
Macromia alleghenienses				X	
Epicordulia princeps				X	
Neurocordulia molesta	X	X	X		X
Zygoptera					
Argia sp.			X	X	X
Argia apicalis		X			
Argia translata	X	X			
Enallagma sp.				X	
Neuroptera					
Corydalus cornutus	X		X		X

APPENDIX V (Continued)

LIST OF SPECIES
QUALITATIVE SAMPLES
OCTOBER 22, 1969

	STATION				
	C-1	C-2	C-3	BE-4	E-5
Trichoptera					
Hydropsyche sp.	X	X			X
Cheumatopsyche sp.	X	X			X
Polycentropus sp.				X	
Cyrnellus fraternus	X		X		X
Leptoceridae			X		
Lepidoptera					
Nymphula sp.				X	
Coleoptera					
Hydroporus sp.	X				
Hydrobius sp.			X	X	X
Sperchopsis sp.				X	
Helichus sp.					X
Ancyronyx variegatus		X	X	X	
Stenelmis sp.	X	X			X
Macronychus galbratus	X	X	X	X	X

APPENDIX V (Continued)

LIST OF SPECIES
QUALITATIVE SAMPLES
OCTOBER 22, 1969

	STATION				
	C-1	C-2	C-3	BE-4	E5
Diptera					
Labrundinia floridana			X		
Ablabesmyia janta			X	X	
Ablabesmyia (*ornata*)				X	
Ablabesmyia hauberi				X	
Ablabesmyia mallochi			X		
Brillia par		X			X
Nanocladius alternantherae		X			X
Orthocladius nr sp.2 - Roback		X		X	
Orthocladius sp. D - Beck					X
Cricotopus bicinctus		X			X
Cricotopus slossonae		X	X		
Cricotopus nr sp.2 - Roback		X		X	X
Trichocladius robacki	X				X
Psectrocladius sp. *B* - Beck				X	
Corynoneura (*Thienemaniella*) *xena*		X			
Ceratopogoninae					X
Tabanidae		X		X	

APPENDIX VI

LIST OF SPECIES COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS AT STATION E-5, CENTURY, FLORIDA

	1965	1966	1968	1969
Nematoda	X			
Oligochaeta	X	X		X
Naididae	X			
Chaetogaster				X
Rhynchelmis sp.	X			
Cladocera				
Sida crystallina	X			
Copepoda	X			
Amphipoda				
Hyallela azteca	X			
Decapoda				
Astacidae			X	
Cambarus diogenes	X			
Orconectes sp.	X			
Plecoptera				
Taeniopteryx sp.	X			
Acroneuria sp.	X	X		
Neoperla clymene	X			X
Paragnetina sp.				X
Isoperla minuta	X			

APPENDIX VI (Continued)

LIST OF SPECIES COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS AT STATION E-5, CENTURY, FLORIDA

	1965	1966	1968	1969
Ephemeroptera				
Hexagenia munda marilandica	X			
Stenonema smithae	X			X
Stenonema exiguum	X	X		X
Paraleptophlebia volitans	X			
Heptagenia sp.				X
Isonychia sp. A	X			X
Baetisca gibberi	X			
Ephemerella trilineata	X			
Tricorythodes albilineatus	X	X	X	X
Caenis sp.	X	X	X	
Caenis diminuta		X		
Baetis spiethi	X			
Baetis sp.				X
Centroptilum hobbsi		X		X
Centroptilum viridocularis			X	X
Cloeon rubropictum				X
Pseudocloeon bimaculatus				X
Caenis hilaris		X		
Anisoptera				
Dromogomphus spinosus	X			
Gomphus pallidus	X			
Macromia illinoensis	X			
Neurocordulia molesta		X		

APPENDIX VI (Continued)

LIST OF SPECIES COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS AT STATION E-5, CENTURY, FLORIDA

	1965	1966	1968	1969
Zygoptera				
Argia sp.	X	X	X	X
Argia apicalis	X			
Argia translata	X			X
Agrion maculatum				X
Ishnura sp.	X			X
Hetaerina americana		X		
Neuroptera				
Corydalus cornutus	X	X	X	X
Climacia areolis		X		
Trichoptera				
Chimarra socia	X			
Hydropsyche sp.	X	X	X	X
Cheumatopsyche sp.	X			X
Leucotrichia sp.			X	
Polycentropus sp.	X			
Cyrnellus fraternus	X		X	X
Hydroptila sp.	X			X
Oecetis sp.	X			X
Triaenodes sp.		X		
Neuriclipsis sp.			X	

APPENDIX VI (Continued)

LIST OF SPECIES COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS AT STATION E-5, CENTURY, FLORIDA

	1965	1966	1968	1969
Coleoptera				
Gyrinus sp.				X
Oreodytes sp.	X			
Helichus sp.			X	
Ancyronyx variegatus		X	X	X
Stenelmis sp.	X	X		X
Diptera				
Labrundinia floridana	X		X	X
Conchapelopia sp.		X		X
Ablabesmyia janta	X	X	X	X
Ablabesmyia auriensis	X			
Ablabesmyia (*ornata*)		X		
Ablabesmyia hauberi				X
Ablabesmyia mallochi	X	X	X	
Potthastia longimanus	X			
Pentaneura (*nilotanypus*) *sp.*		X		
Pentaneura inculta	X	X	X	X
Brillia par		X		
Nanocladius alternantherae	X	X	X	X
Orthocladius nr sp.2 - Roback	X			
Orthocladius sp. D - Beck	X			
Orthocladius sp.	X			

APPENDIX VI (Continued)

LIST OF SPECIES COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS AT STATION E-5, CENTURY, FLORIDA

	1965	1966	1968	1969
Cricotopus bicinctus	X	X	X	X
Cricotopus slossonae			X	
Cricotopus nr sp.2 - Roback	X		X	X
Cricotopus sp.				X
Trichocladius robacki	X			X
Trichocladius sp.	X			
Corynoneura (Thienemaniella) xena	X			X
Corynoneura celeripes	X			X
Chironomus (C) attenuatus	X			
Chironomus (Polypedilum) illinoense		X		
Chironomus (Dicrotendipes) modestus		X	X	
Chironomus (Xenochironomus) xenolabis		X		
Chironomus (Cryptochiromus) parafulvus	X	X	X	
Parachironomus directus				X
Parachironomus sp.	X			
Parachironomus carinatus		X	X	X
Polypedilum (Polypedilum) fallax			X	
Polypedilum (Polypedilum) illinoense			X	X
Polypedilum (Pentapedilum) tritum	X		X	X
Polypedilum sp.	X			X
Phaenopsectra (obediens)	X			
Chironomi o. Beck	X			X
Microtendipes nr caducus	X			

APPENDIX VI (Continued)

LIST OF SPECIES COLLECTED IN ARTIFICIAL SUBSTRATE SAMPLERS AT STATION E-5, CENTURY, FLORIDA

	1965	1966	1968	1969
Stictochironomus devinctus	X		X	X
Tanytarsus (*Rheotanytarsus*) *exiguus*	X	X		X
Tanytarsus glabrescens				X
Tanytarsus sp.	X	X		
Tanytarsus flavellus	X			
Tanytarsus guerla	X			
Tanytarsus sp.2 Roback	X			
Tanytarsus nr sp.1	X			
Tanytarsus sp.5 Roback	X			
Tanytarsus sp.a. Beck		X		
Chironomini L. Beck		X		
Gastropoda				
Physa sp.			X	
Ferissia sp.	X	X		X
Goniobasis sp.	X			X
Pelecypoda				
Corbicula fluminea	X	X	X	
Sphaerium sp.	X			

APPENDIX VII
ESCAMBIA RIVER NITROGEN AND PHOSPHORUS SERIES

Station Location	Date	Time (Hrs)	Nitrogen Series			Phosphorus Series	
			Kjeldahl (mg/l)	NH_3 (mg/l)	NO_2-NO_3 (mg/l)	Total P (mg/l)	Ortho P (mg/l)
Conecuh River @ US 29 (Brewton, Ala.)	9-19	1300	0.72	0.130	0.045	0.010	0.005
Conecuh River @ Pollard, Ala.	9-19	1410	0.83	0.125	0.020	0.055	0.024
Big Escambia Creek @ US 29-31 (Flomaton, Ala.)	9-19	1000	0.28	0.015	0.120	0.010	0.005
Escambia River @ Rt 4 (Century, Fla.)	9-16	1210	0.12	0.010	0.052	0.050	0.012
	9-17	1730	0.50	0.050	0.075	0.047	0.014
	9-18	1000	0.28	0.010	0.051	0.080	0.016
	9-19	1035	0.30	0.100	0.045	0.053	0.015
	9-19	1500	0.44	0.235	0.045	0.056	0.014
	9-20	2400	0.75	0.025	0.051	0.084	0.032
Escambia River @ Rt 184	9-17	1305	0.10	0.020	0.100	0.050	0.010
	9-17	1820	0.22	0.045	0.099	0.015	0.011
	9-18	0815	0.10	0.010	0.086	0.060	0.009
	9-19	1140	0.81	0.215	0.088	0.040	0.017
	9-19	1520	0.29	0.065	0.080	0.022	0.010

MR. THOMAN: The report of the Federal Water Pollution Control Agency was just finished in its printing late last week. We conducted this study at the request of Governor Kirk last fall, and the report was only finished shortly after Christmas, and in getting the necessary clearances and having it printed, it wasn't available in our normal course of events which is to have the report ready for distribution at the time the Secretary makes the official call of the conference. So I will apologize for the delay. It came a little faster than we expected, and we weren't able to get it into everyone's hands at the time that we wished to.

This report will be presented today by Mr. Paul Traina, who is Director of the Technical Programs at our Southeast Water Laboratory in Athens, Georgia.

Without any further ado, Mr. Traina.

STATEMENT OF PAUL J. TRAINA, DIRECTOR,
TECHNICAL SERVICES, SOUTHEAST WATER
LABORATORY, FEDERAL WATER POLLUTION
CONTROL ADMINISTRATION, ATHENS, GEORGIA

MR. TRAINA: Thank you, Mr. Thoman.

Mr. Chairman, Dr. Myers, Mr. Reed, my name is

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Paul Traina, Director of Technical Programs, Southeast Region of the Federal Water Pollution Control Administration.

Mr. Thoman has indicated that an official copy of our report has been given for the record. I would like to, however, summarize that report now.

By way of introduction, in August of 1969, the Southeast Region of the Federal Water Pollution Control Administration received a request for technical assistance in evaluating interstate and intrastate pollution from waste sources entering the Conecuh-Escambia River downstream of Brewton, Alabama, and Escambia Bay near Pensacola, Florida. This request was transmitted from the Governor of Florida through the Florida Department of Air and Water Pollution Control.

This report presents an evaluation of the data collected during these studies.

Escambia Bay is one of the northeast branches of Pensacola Bay. It is a shallow estuary with depths ranging from 3 to about 15 feet. Pensacola, the largest city in the area, lies along the northern shore of Pensacola Bay. The 1965 population of the metropolitan area was 224,000.

Fresh water enters Escambia Bay from the Escambia River which has the fifth largest average flow in Florida.

Ground water, which is plentiful and of good quality, is the primary source for municipal and industrial supplies. A sand and gravel aquifer lies 200 to 1,000 feet below land surface, and yields large quantities of soft, unmineralized water.

During the Escambia Bay field investigations, air temperatures at Pensacola averaged from 75 to 78 degrees Fahrenheit. No rainfall occurred at Pensacola during the sampling of Escambia Bay, although several days earlier a tropical depression from the Gulf caused heavy rains to the north and east of the area. Although normal rainfall for September is 7.69 inches, only 3.09 inches were recorded for September 1969, a deficiency of 4.60 inches for the month.

Flows on the Escambia River near Century during the Escambia Bay field study ranged from 914 to 11,600 cfs.

The Escambia River is formed by the junction of the Conecuh River and Escambia Creek just north of the Alabama-Florida State line. The drainage basin of the Escambia River contains 3,800 square miles, and based on a 30-year period of record near Century, Florida, has an average annual flow of 6,100 cfs, and a maximum and minimum flow of 77,200 cfs and 596 cfs, respectively. Based on a period of record from 1935 to 1965, the 7-day minimum

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flow with a recurrence interval of 10 years is 785 cfs.

Record low flows occurred in 1968 including a 7-day low flow of 614 cfs occurring in September.

The average daily flows occurring during the period of the Escambia River study in October ranged from 1,350 to 1,770 cfs.

The Escambia River is characterized by an upper reach from Brewton, Alabama, to Molino, Florida, having moderate gradiant, and a lower section from Molino to the bay having negligible gradiant. The upper region of moderate gradiant is characterized by swift current with steeply cut banks, and from Molino downstream the current is sluggish and the river flows through low swampy areas with sloughs and back waters.

Salt water penetration is dependent on river flow, and during periods of low flow reportedly may extend upstream a distance of approximately 8 miles from the mouth of the river.

I would like now to discuss water uses first in the bay and secondly in the river.

Escambia Bay is a recreational as well as commercial center utilized by fishermen, pleasure boaters, and shellfish harvesters. Typical of most estuaries it has provided a spawning ground and nursery for several species of aquatic life. The bay has also become an industrial center with extensive commercial water traffic in the channel. Wastes from municipal and industrial sources are discharged to Escambia River and Bay. Recreational and commercial fishing uses of the bay have declined in recent years.

All of Escambia Bay except the area east of the center of the bay and south of the Louisville and Nashville Railroad bridge has been classified by the State of Florida as Class III: recreation, propagation, and management of fish and wildlife.

A summary of the requirements for this category are: 1) sewage and industrial wastes shall receive modern, effective treatment; 2) receiving waters shall not vary more than one unit on the pH scale and in no case be less than 6.0 or greater than 8.5; 3) dissolved oxygen levels shall not be artificially depressed below 4.0 milligrams per liter; 4) bacteria of the coliform group shall not exceed 1,000 per 100 milliliters, as a monthly average; 5) no substances shall be present which are toxic or harmful to humans, animal or aquatic life; 6) the water shall be free from materials attributable to municipal, industrial, agricultural and other discharges producing color, odor or other conditions in such degree as to create a nuisance;

7) turbidity shall not exceed 50 Jackson units above background; and 8) temperature shall not be increased so as to cause damage to aquatic life.

The southeast portion of Escambia Bay below the L&N railroad bridge has been established by the State as Class II shellfish harvesting. The criteria for shellfish harvesting are similar to the recreational values I just read, the major difference being a more stringent bacteriological requirement.

Escambia Bay has been a prolific spawning ground for many species of fish -- crab, shrimp and oyster. Among these, many species have important sport and commercial value including brown and white shrimp, mullet, menhaden, flounder, redfish, speckled trout, and oysters. Numbers of white shrimp have markedly decreased in recent years. Sport fish in general also appear to be present in fewer numbers in the bay in recent years.

At least 17 documented fish kills have occurred in the area over the past year. Most of these kills occurred in Mulat-Mulatto Bayou. Several major kills also occurred in the northern section of Escambia Bay near the marsh flats.

A major fish kill occurred in Mulat-Mulatto Bayou in June 1969. The Federal Water Pollution Control

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Administration made an investigation of this particular kill at the request of the Governor of Florida. Results of the study showed that dissolved oxygen was greatly reduced in the bayou. The present study is the result of a recommendation made in that report for an extensive nutrient source survey in Escambia River and Bay.

Lower Escambia Bay south of the railroad bridge and east of the bay's center line is an approved area for oyster harvesting. Most of the area has been leased by commercial firms for private harvesting.

The Monsanto Corporation and Gulf Power Company located on the Escambia River utilize barges to bring raw materials and fuel to their plants. Escambia River and Bay are also utilized as sources of cooling water by several of the industries located in the area.

Finally, the estuary also is used as a means of waste disposal.

All of the Conecuh-Escambia River drainage is classified as fish and wildlife use in Alabama; and Class III, recreation, fish and wildlife, in Florida. The Conecuh-Escambia River in the area of the Alabama-Florida State line contains a very diversified fish population. Among the species of importance to the sport and commercial fishermen are the large mouth and spotted bass, bluegill, crappie, warmouth, rock bass, white bass, and channel catfish.

The Florida Game and Fresh Water Fish Commission, in a comparison of fish collected with rotenone from the upper river in 1957 and 1967, reported a dramatic decrease in total numbers and total weight of fish over the 10-year period.

I would like now to discuss the waste discharges to the area.

The major organic waste sources discharging to Escambia River and Bay are Container Corporation of America at Brewton, Alabama; Monsanto Company, Escambia Chemical Company, American Cyanamid Company, and the Northeast Sewage Treatment Plant of the city of Pensacola, Florida. In addition to these organic waste discharges, the Gulf Power Company and Monsanto Company release used cooling water to the lower reaches of the Escambia River. All of these sources except the Container Corporation are in the Pensacola metropolitan area.

The effects of organic waste effluent on the quality of the receiving waters can be characterized by the carbon, nitrogen, and phosphorus content. These three substances have both direct and indirect effects on the dissolved oxygen distribution.

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A summary of the organic waste discharges collected during the survey of September 10-20, 1969, is presented in Table 2 in the report.

Biochemical oxygen demand, BOD, is a measure of the quantity of oxygen that will be used in stabilizing the waste materials in a stated period of time. Each pound of total organic carbon, TOC, discharged requires 2.67 pounds of oxygen from the receiving waters during stabilization to carbon dioxide.

Total Kjeldahl nitrogen, TKN, is a measure of the total unsatisfied nitrogen as both nitrogen and ammonia. Each pound of this material reported as nitrogen requires 4.57 pounds of oxygen during stabilization to nitrates.

The sum of these two values represents the theoretical oxygen demand, TOD, in the receiving water which is necessary to completely stabilize the unoxidized carbonaceous and nitrogenous content of the waste discharges.

Phosphorus, as well as carbon and nitrogen, is a growth requirement for aquatic plants. Excessive phosphorus in the receiving water could stimulate both directly and indirectly excessive and undesirable populations of plankton and thereby upset the ecological balance among competing species.

Container Corporation of America operates a bleached kraft pulp and paper mill at Brewton, Alabama. The plant discharges approximately 36 million gallons a day of waste into a series of settling basins and natural ponds which provide about five days retention time before the effluent is discharged to the Conecuh River about 50 miles upstream from the mouth of the Escambia River. In the settling ponds, pure oxygen is diffused into the waste. The average 5-day BOD discharged to the Escambia River is 7,420 pounds per day, and is 32.7 percent of the total BOD discharged. Container Corporation of America also discharges the largest quantity of total organic carbon of any waste source in the study area; a mass of 10,410 pounds per day, which is 52.5 percent of the total.

This plant discharges 495 pounds per day of total Kjeldahl nitrogen, 193 pounds per day of ammonia-nitrogen, and 3.4 pounds per day of nitrite-plus-nitrate nitrogen, representing 4.3, 3.2, and 0.1 percent respectively of the total discharged to the area.

The total nitrogen discharge is relatively small from Container representing a population equivalent of 20,450.

The waste loads of total and ortho-phosphates are 150 and 73 pounds per day, representing 13.6 and 9.6 percent of the total input respectively.

The theoretical oxygen demand of Container's waste is 30,380 pounds per day or 28.5 percent of the total amount.

Monsanto Company, a manufacturer of nylon fiber, injects 2.6 million gallons a day of highly organic process and domestic waste into two deep strata wells and discharges an average of 52.5 million gallons a day of cooling water, boiler condensate, and waste from their water treatment plant to the Escambia River, about 7 miles above the mouth. Two outfalls were monitored during the survey -- the main outfall which was reportedly discharging cooling water, and the boiler condensate ditch. Data collected from these outfalls indicate that a highly significant quantity of process waste is being discharged with the cooling water and boiler condensate effluents. The 5-day BOD discharge from the plant is 10,100 pounds per day, which at 44.4 percent of the total is the largest waste source.

The amount of TOC, total organic carbon, in the effluent, is 3,900 pounds per day, and 19.7 percent of the total contribution.

The quantity of TKN discharged by Monsanto is

1,875 pounds per day, representing 16.3 percent of the total contribution. The mass of ammonia-nitrogen and nitrate-plus-nitrite nitrogen discharged are 1,104 and 1,331 pounds per day, which are 18.0 percent and 30.2 percent of the total waste contribution.

Monsanto is also the most significant source of total phosphate contributing 38.1 percent of the total.

The total phosphate discharged is 421 pounds per day. The contribution of ortho-phosphate is 264 pounds per day, or 34.7 percent of the total.

The theoretical oxygen demand of the Monsanto discharge is 18,950 pounds per day or 17.9 percent of the total.

Escambia Chemical Company is located on the northeastern shore of Escambia Bay near Floridatown, Florida. Fertilizer, alcohol, ammonia polyvinyl chloride are manufactured at this plant, which discharges about 5.2 million gallons a day of waste through a swampy area. The retention time is estimated at two days. This source accounts for about one percent of both the 5-day BOD and TOC discharged to the study area. However, it is the most significant source of nitrogen contributing 47.2 percent of the ammonia-nitrogen, 53.9 percent of the nitrite-plus-nitrate nitrogen, and 28.5 percent of the total Kjeldahl nitrogen.

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Escambia Chemical discharges 2,380 pounds per day of nitrite-plus-nitrate nitrogen — more than all other sources combined. The quantity of TKN discharged is 3,270 pounds per day. The total nitrogen is the largest quantity discharged to the study area collectively amounting to 35.6 percent of all sources.

A discharge of 320 pounds per day of total phosphate from Escambia Chemical accounted for 28.8 percent of the total. Ortho-phosphate, the most readily available form for algal assimilation, amounts to 310 pounds per day discharged, which is 41.3 percent of the total contribution thus making Escambia Chemical Company the largest source of ortho-phosphate.

The theoretical oxygen demand of the waste effluent from Escambia Chemical Company is 15,470 pounds per day amounting to 14.6 percent of all discharges.

American Cyanamid Company manufactures synthetic fibers at a plant located on the eastern shore of Escambia Bay just north of Mulat-Mulatto Bayou. It discharges approximately 4.5 million gallons a day of industrial and domestic waste after primary treatment to the bay through a 1,200 foot submerged outfall. This waste source accounts for 19.6 percent of the 5-day BOD and 26.3 percent of the TOC discharged. The 5-day BOD discharged is 4,450 pounds

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per day, and the TOC discharged is 5,230 pounds per day.

American Cyanamid discharges 4,160 pounds per day of total Kjeldahl nitrogen or 36.2 percent of the total contribution primarily in the form of organic nitrogen. American Cyanamid is the largest source of unstabilized organic nitrogen. The total nitrogen PE of this waste is second only to that discharged by Escambia Chemical Company. About 8.8 percent of the ammonia-nitrogen and 15.7 percent of the nitrite-nitrate nitrogen are discharged by American Cyanamid. Phosphate discharged by American Cyanamid is negligible. American Cyanamid discharges 32,950 pounds per day of theoretical oxygen demand. This is the largest single source of oxygen-demanding material amounting to 31 percent of the total.

The Northeast Sewage Treatment Plant is operated by the city of Pensacola and is the only waste source discharging principally domestic waste. This trickling filter plant is located on the western shore of Escambia Bay approximately two miles south of the I-10 bridge, where it discharges approximately one million gallons a day of chlorinated secondary effluent through a submerged outfall.

Immediately before the survey, wastes from Westinghouse and Ellyson Field Naval Air Station were intercepted and diverted to the Northeast Sewage Treatment Plant. Construction to divert wastes from the Evergreen Subdivision to this plant was in the last stages of completion at the time of the survey.

Carbonaceous waste discharged from this plant is insignificant compared to other waste sources. The TKN and ammonia-nitrogen discharges are 1,684 and 1,393 pounds per day respectively. The total nitrogen amounts to 14.7 percent of the total Kjeldahl nitrogen and 22.8 percent of the ammonia-nitrogen discharged from all sources. The quantity of nitrite-plus-nitrate nitrogen in the effluent is negligible.

The Northeast Sewage Treatment Plant discharges 213 pounds per day of total phosphate and 107 pounds per day of ortho-phosphate. These values represent 19.2 percent and 14.1 percent respectively of the total contribution.

The effluent of the Pensacola plant has the lowest theoretical oxygen demand of 8,050 pounds per day.

The community of Century, Florida, just south of the Alabama-Florida State line, discharges untreated wastes from 50 to 60 homes, a sawmill and a small hospital. The effluent goes to the swampy flood plain through which it flows approximately two miles to the Escambia River.

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In summary, the total population equivalent -- and this is a term used to equate the waste contribution of an industry to that of a city -- the total population equivalent of 5-day BOD discharged to the study area is 136,320. The Monsanto Company discharges the largest mass of 5-day BOD, with Container Corporation of America and Cyanamid also contributing significant quantities. These three sources account for 97 percent of the total BOD.

A point needs to be made, however, that of the 7,420 pounds per day of 5-day BOD discharged by the Container Corporation of America, approximately 1,460 pounds per day of unstabilized material remain in the Escambia River when it becomes an estuary. With this reduction of organic materials in the river above the bay, the Container Corporation contribution to the estuary is 8.9 percent of the total 5-day BOD affecting water quality in Escambia Bay or 8,760 population equivalent.

The relative percent contribution of 5-day BOD of Monsanto to the estuary is increased to 60.3 percent of the total with the contribution of all other waste sources increasing slightly to compensate for the Container's decrease. The total population equivalent of 5-day BOD reaching the estuary from all waste sources is 100,550.

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The total nitrogen discharged is equivalent to that produced by a population of 651,400 persons. This is a massively excessive total compared to the domestic population. It is a significant cause of the water quality degradation of Escambia Bay by nutrient material. The most significant sources are Escambia Chemical, discharging the largest quantity, and American Cyanamid, discharging slightly less. These two sources collectively discharge more than 66 percent of the total nitrogen. When Monsanto's contribution of 131,200 is added, more than 86 percent of the total nitrogen is accounted.

The total phosphorus population equivalent to the study area is 135,060. All industries except American Cyanamid contributed significant amounts. Escambia Chemical and Monsanto collectively discharge 67 percent of the total.

Effluent samples were collected from the Monsanto Company, Escambia Chemical Company, and the American Cyanamid Company, for examination for suspected specific complex compounds which may be toxic to aquatic life. Gas chromatograph and mass spectroscopy analyses were conducted on each sample. In the Monsanto effluent no compounds were present greater than 5 milligrams per liter. Polychlorinated biphenyl compounds (PCB) were not detected at a sensitivity of 1 part per billion (ppb) in any of the three Monsanto samples. However, diphenyl

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oxide, known as phenyl, was present at an estimated concentration between 20 and 50 parts per billion in the sample collected from the north outfall. The toxicity of this substance to aquatic life has not been determined. No compound in the Escambia Chemical effluent had concentrations greater than 5 milligrams per liter. This sample was also analyzed for methanol, which was not present at one milligram per liter.

The American Cyanamid effluent sample contained acrylonitrile as a concentration of about 100 milligrams per liter. Acrylonitrile is a monomer used in acrylic fiber. This compound is known to be highly toxic to rodents and has been used as a fumigant for insect control. Acrylonitrile has a higher lethal death capability than DDT for rats. Furthermore, acrylonitrile unlike DDT is moderately soluble in water. In fish toxicity studies, a concentration of 30 milligrams per liter caused 100 percent mortality to pin perch, a marine fish. Lesser concentrations resulted in lesser mortalities.

In addition to acrylonitrile, American Cyanamid also reportedly discharges 180 to 190 milligrams per liter of sodium thiocyanate, which is used as a solvent. Sodium thiocyanate is basically a very stable compound with high solubility. In the presence of chlorine it breaks down to

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release cyanide, an extremely toxic substance to any aquatic life. However, such an occurrence would be highly unlikely in the bay unless one of the immediate waste sources discharges free chlorine.

Monsanto Company and Gulf Power Company discharge quantities of heated water after use for cooling purposes. The volume of Monsanto and Gulf Power discharges are approximately 50 and 150 million gallons a day respectively.

To obtain an estimate of the effect of these discharges on the temperature regime of the lower portion of the river, data on vertical and horizontal profiles of water temperature were collected from above the Monsanto Chemical Company outfall downstream to just below Highway 90 bridge. Surface waters immediately adjacent to the Monsanto outfall ditch are increased 19.5 degrees Fahrenheit over the background temperature of 68 degrees Fahrenheit of the river immediately above the outfall. The heated effluent lies near the surface and water temperature returns to near ambient below a depth of 6 feet. One hundred yards below the Monsanto outfall most of the heated water is near the surface on the left bank and has a maximum temperature of 81 degrees Fahrenheit and is 13 degrees Fahrenheit over background. At a distance of 300 yards below the outfall, the heated effluent is well mixed horizontally with a surface temperature of 75 degrees Fahrenheit. At this point, the heated water is in the surface two feet.

The Gulf Power effluent increases river temperatures from 70.25 degrees Fahrenheit to 82.5 degrees Fahrenheit or 12.25 degrees over background. This heated effluent clings to the left shore line in the upper 6 feet of water and is still evident at Highway 90 bridge, one mile below the effluent ditch, where the upper 6 feet of water along the right quarter of the river is still 7.25 degrees F. higher than the temperature of the river immediately above Gulf Power Company.

The effect of these elevated temperatures on biological life in the Escambia River has not been directly ascertained since there are other factors such as discharge of organic wastes and physical variations in flow and natural sediment load which could cause the deleterious alterations in the biological community. However, the National Technical Advisory Committee to the Secretary of the Interior has recommended water temperature in estuaries should not be increased more than 4 degrees Fahrenheit from September to May, nor more than 1.5 degrees Fahrenheit during June through August. On this

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basis, both Monsanto Company and Gulf Power Company are discharging thermal pollution to the Escambia River.

Now, I would like to discuss the water quality that we found in Escambia Bay.

Predominant current patterns in Escambia Bay were derived from chloride analyses at 28 locations collected 10 times at each location synoptically during the period September 23 through September 25, 1969.

Based on our measurements, the net outflow of water from the bay is along the western portion with intrusion of saline water on the eastern side generally producing a counter-clockwise circulation pattern. There is an area of very little flushing in the northern marsh flats above the mouth of the Escambia River. Several of the fish kills have occurred in this area.

At the point where the Louisville and Nashville Railroad crosses the bay, there is a decrease in chloride concentrations on the northwest side. Fresh water is being held in the area just north of the bridge and is not able to discharge and disperse at a constant rate out of the bay. The area under the railroad trestle is congested due to closely spaced supporting piles, and in some cases no more than 3 or 4 feet on center. These pilings occupy a significant percentage of the total cross sectional area under the trestle and reduce the volume available for passage of water. Therefore, any wastes discharged above the trestle remain in this section of the bay and exercise an organic demand for a longer period of time. This includes all the waste sources except the Northeast Sewage Treatment Plant. The present L&N Railroad trestle adversely affects water quality in the upper half of the Escambia Bay by retarding flushing and exchange.

Nitrogen together with carbon and phosphorus are the major necessary ingredients in establishing a healthy ecological balance between competing species in Escambia Bay. These three constituents in organic form are stabilized by bacteria utilizing dissolved oxygen from the water. The stabilized materials now in inorganic form are available to the algae who produce dissolved oxygen. As algae, bacteria, and other organisms die, the carbon, nitrogen, and phosphorus contained in their biomass again become sources of nutrients for succeeding generations in this cyclical process.

The discharge of excessive wastes containing carbon, nitrogen, and phosphorus upsets this balance and causes a stimulation of both bacterial and algal populations. The water becomes more noticeably turbid and, as the result of respiration by the increased populations,

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there is a great increase in oxygen consumption resulting in a significant lowering of dissolved oxygen during the night.

Oxygen-dependent higher organisms, such as fish, may be stressed to the point where they can no longer survive.

The maximum concentration of total Kjeldahl nitrogen are in the northeast section of Escambia Bay in the vicinity of the Escambia Chemical and American Cyanamid outfalls. These surface values are approximately 3 to 4 times greater than other parts of Escambia Bay, exhibiting a maximum mean value of 1.90 milligrams per liter near the Escambia Chemical discharge.

Ammonia-nitrogen exhibits the same distribution pattern as TKN with most of Escambia Bay showing concentrations between 0.1 and 0.2 milligrams per liter except for the northeast section and, to a lesser extent, the eastern portion. The maximum mean surface concentration of 1.60 milligrams per liter was as much as 32 times greater than the western and central sections of the bay.

Nitrite-nitrate nitrogen was at a maximum in the northeast section where it was more than 10 times greater than the rest of the bay at a surface mean concentration of 1.16 milligrams per liter.

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The northeast section of Escambia Bay is excessively over-enriched with nitrogen as the result of the discharges from Escambia Chemical and American Cyanamid. Only very minute quantities of phosphorus are sufficient in maintaining a healthy biological balance. It is a required nutrient and artificial inputs are amenable to control and abatement. Ortho-phosphate is the form most readily available to algae. Total phosphate concentrations at the surface of Escambia Bay are highest in the northeast section and in the southwest, south of the L&N Railroad trestle. The maximum mean concentration is offshore of the Escambia Chemical discharge. The second highest surface concentration is just north of the effluent discharge from the city of Pensacola's Northeast Sewage Treatment Plant.

Ortho-phosphate concentrations exhibited the same distribution as total phosphate with the maximum concentrations for surface and bottom being observed offshore of Escambia Chemical. The second highest surface concentration is north of the outfall from the Northeast Sewage Treatment Plant.

The major waste effluent affecting phosphate concentrations in the northeast section of Escambia Bay is Escambia Chemical Company, the largest dischargers of

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ortho-phosphate of all waste sources. The source of the high surface total and ortho-phosphate in the southwest part of the bay is the Northeast Sewage Treatment Plant effluent.

Mean concentrations of dissolved oxygen at the surface of Escambia Bay are all greater than 4 milligrams per liter. The lowest mean concentrations are in the northern section near the marsh flats. These concentrations are greater than 5 milligrams per liter. Surface concentrations in the central and southern portions of the bay are generally between 7.0 and 9.0 milligrams per liter. However, there is a great amount of variation in almost all of the locations sampled north of the L&N Railroad bridge. At one station, as an example, the maximum surface concentration was 8.3 milligrams per liter, while the mean was 1.0 milligrams per liter. Forty percent of the samples are less than 4.0 milligrams per liter. The higher concentrations invariably occur during daylight and the lower values are observed at night. This is a classical dissolved oxygen distribution caused by variation in algal photosynthesis.

The bay is relatively shallow, and has poor circulation in this section. It also is the section of the bay containing the highest nutrient concentrations.

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All of these factors are conducive to increased algal activity and production. Because of phytoplankton activity, dissolved oxygen concentrations on the surface in the northern section of the bay frequently are less than 4.0 milligrams per liter, and could conceivably be completely absent with the warmer water temperatures which occur during July and August. These variations are partially responsible for the fish kills occurring in the northern section of the bay. Fish may swim into the area during the day when dissolved oxygen is high -- since the marshes are a natural source of food supply -- and become trapped when there is a rapid decline after sunset. The major stimulants to excessive planktonic photosynthesis and respiration in the northern section of the bay are the excessive quantities of carbon and nitrogen discharged by the American Cyanamid Company, and of nitrogen and phosphate discharged by the Escambia Chemical Company.

The effect of these wastes is demonstrated by consideration of the mean theoretical oxygen demand. The highest surface concentrations are in the vicinity of these outfalls and are almost twice as high as the remainder of the bay. The bottom concentrations are also higher.

In addition to respiration by algae, dissolved oxygen can be reduced directly through stabilization of the theoretical oxygen demand. Photosynthesis and respiration by algae are apparent in all areas of the bay north of the L&N Railroad bridge. In the central part of the upper bay, the dissolved oxygen range is 5.0 to 11.8 milligrams per liter. Although none of the surface observations are less than 4.0, this range of 6.8 milligrams per liter is indicative of a highly enriched environment.

In the eastern section of the upper bay, the surface range of dissolved oxygen is also 6.8. Variation in the lower bay is significantly less reflecting the improved flushing and exchange as well as the generally lower concentrations of nutrient material. The surface range of dissolved oxygen is about 3.5 milligrams per liter with the mean of 8.7 milligrams per liter. There is very little variation in the bottom dissolved oxygen.

Although phytoplankton populations are not of themselves directly correlated with activity manifested through photosynthesis and respiration, they do illustrate imbalances within the system. The population in most of the bay is relatively constant: between 5,000 and 6,000 cells per milliliter. However, in the vicinity of the southern entrance to Mulat-Mulatto Bayou, the populations rapidly increased to about three times the concentration in the rest of Escambia Bay. The source of these phytoplankton populations is Mulatto Bayou. It is also the major source of the high nitrogen and phosphorus concentrations observed on the eastern side of the bay below the L&N bridge. There is a significantly lesser concentration of dissolved oxygen near the bottom of Escambia Bay compared to the surface. About 43 percent of the area of the bottom of Escambia Bay has dissolved oxygen of less than 4.0 milligrams per liter. Above the L&N bridge the percentage of the bay less than 4.0 milligrams per liter is about 60 percent.

The oxygen demand of benthic deposits is the major factor affecting dissolved oxygen in the bottom water. To a lesser extent, the TOD also causes lower oxygen concentrations. A significant portion of the bottom of Escambia Bay north of the L&N bridge, amounting to more than 57 percent of the area, is covered with a blanket of oxygen-demanding sludge. The only sections with less than 3 percent organic carbon content are the extreme northern part and the area around the mouth of Mulat-Mulatto Bayou. The highest concentrations of sludge deposits in Escambia Bay are centered around the American Cyanamid and Escambia Chemical outfalls. Organic carbon content in this area is nearly 6 percent.

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Water quality in Mulat-Mulatto Bayou: Many of the reported fish kills in 1969 occurred in Mulat-Mulatto Bayou on the eastern side of Escambia Bay. Within the past 5 years, a new opening to Escambia Bay connecting to the southern arm of the bayou has been dredged. The bottom material removed was used as a fill for the new I-10 bridge, and in some sections this new channel is more than 20 feet deep.

Joining this new channel, a series of channels, dredged for a nearby residential area, have recently been constructed. These physical alterations have deleteriously affected the natural flushing and exchange of material from Mulat-Mulatto Bayou.

Dissolved oxygen concentration on the surface is between 8 to 10 milligrams per liter with the highest values being observed in Mulat-Mulatto Bayou. These concentrations are greater than saturation and indicate excessive photosynthesis. At the 4-foot depth, dissolved oxygen is generally satisfactory at about 4 milligrams per liter. However, in the borrow area, dissolved oxygen is completely absent below this depth.

Furthermore, concentrations of total nitrogen and total phosphate at the 20-foot depth are 10 to 20 times greater than in all other areas of the bayou.

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The borrow area has become a settling basin for suspended organic material including algal organisms. Very high oxygen demand of this material has totally depleted dissolved oxygen and has turned this area into an anaerobic digester of organic wastes. The source of these organic deposits are siltation from dredging of the canals for adjacent residential developments; wastes from Escambia Chemical and American Cyanamid (and under certain current conditions in lesser concentrations Monsanto and Container) which come in through the northern entrance to Mulat-Mulatto Bayou; and deposits from dead algal and bacteria growths resulting from the excessive nutrient concentrations in the bayou.

Although Mulat-Mulatto Bayou is a desirable nursery area for sport fish, visual observation indicates that the entire bottom is covered with a thick organic ooze which emits a pronounced high nitrogen sulfide odor when disturbed. Most of the bottom grasses which are feeding grounds for fish have been replaced by these sludge beds.

The combination of waste input, poor circulation caused by alteration of the natural physical configuration, and dredging practices are the major causes of the fish kills occurring in Mulat-Mulatto Bayou.

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I would like now to describe the water quality of the Escambia River. First, as a background, there have been numerous studies of the Escambia River by State and Federal agencies and by industry. These reports and all data that were available for review are summarized as follows: 1) There has been an increase in color below the Container Corporation plant at Brewton, Alabama. The color increase has been particularly pronounced since 1964-1965 and is apparent a considerable distance into Florida. 2) Total coliform levels were found to be elevated at stations below the junction of Murder and Conecuh Creeks and extending downstream to Highway 4 bridge at Century, Florida. 3) Slime growths attributable to wastes from Container Corporation are present in the river and in some years have been apparent as far downstream as Highway 4 bridge at Century. 4) Studies of aquatic biota have shown that diversity and quality of the macro-invertebrate populations in a limited reach of the river below the Container discharge are reduced.

The section of the river in which the biota is appreciably affected has varied from year to year but has been generally restricted to the reach between the Container discharge and the Alabama-Florida State line.

The station at Highway 4 bridge near Century

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has been intensively studied for a period of over 10 years and with the exception of 1961, the river at this station has supported a diverse and healthy community of aquatic macro-invertebrates.

In 1961, a fish kill attributed to a spill of wood preservative chemical occurred and the benthic studies at Century indicated a reduction in the quality and diversity of the fauna.

During our surveys conducted in September and October, grab samples were collected at most of the river stations sampled. Dissolved oxygen is consistently high in the White River and at all Escambia River stations above the Monsanto outfall. At stations below Monsanto, the surface dissolved oxygen is high, but in the deeper waters, oxygen is decreased to levels ranging from 1.5 to 3.2 milligrams per liter.

Color levels increased 40 to 50 units in the Conecuh River immediately below the Container Corporation outfall. These high levels are still apparent in the Escambia River at Century, but are reduced to near background at Highway 184 bridge approximately 40 miles downstream.

In 1965, 1968, and 1969, the Federal Water Pollution Control Administration collected biological data

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at Century as part of its southeastern regional surveillance program. These data were collected by the placement of artificial substrate samplers for a period of 4 to 6 weeks during a period of low flow from July through September. The levels of biological diversity -- a measure of the richness of species found during 1965 and 1969 at Century -- are comparable to levels of diversity found at surveillance stations in the southeast where waters are known to be of high quality. The diversity in 1966 and 1968, however, are comparable to levels found in other southeastern rivers which are known to be degraded by oxygen-demanding wastes.

Based on equitability levels which are a measure of the distribution of individuals among species, the biota in the Escambia River at Century during the period of study in 1965 and 1969 were not degraded by wastes from upstream sources. In 1966 and 1968, however, the imbalance in the distribution of abundance of species is indicative of a degradation of the habitat at the time surveillance studies were conducted.

Flows during late summer in both 1966 and 1968 were much lower than normal. Flows during the time samples were in place were near 1,000 cubic feet per second, and in September 1968, the low flow of record was reported at the Century station.

From July through September 1969, dissolved oxygen readings at Century, as recorded by an FWPCA automatic quality monitor, were never below 4.5 milligrams per liter.

An examination of the frequency distribution of the dissolved oxygen values at Century indicate that levels were above 5.0 milligrams per liter, 82 percent, 90 percent, and 100 percent of the time during July, August and September, respectively.

In the October field survey, qualitative samples of benthic macro-invertebrates were collected from Brewton, Alabama, downstream to Century Florida.

The diverse community of macro-invertebrates encountered are indicative of healthy stream conditions at the time of sampling and for a period of at least 2 to 4 weeks prior to the time of sampling.

The present ecological imbalance of Escambia Bay and Mulat-Mulatto Bayou did not occur suddenly. The water quality degradation has developed many years through discharging untreated wastes and inadequately treated wastes, and from uncoordinated alteration of the bay's natural physical configuration. Restoration of water quality which will support a wide diversity of desirable

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water uses requires immediate adoption and enforcement of abatement regulations for all municipal and industrial polluters. The carbon, nitrogen, and phosphorus discharges from Escambia Chemical Company, American Cyanamid Company, the Northeast Sewage Treatment Plant at Pensacola, Monsanto Company, and Container Corporation of America should be reduced to levels that will not stimulate the excessive activity of floating algae and bacteria, which is the major cause of the fish kills in Escambia Bay and in Mulat-Mulatto Bayou.

Recent literature reports have indicated that the availability of carbon dioxide is a major factor in accelerated eutrophication. The concentration of available carbon dioxide is a function of the carbonaceous material discharged from waste sources, uncontrollable inputs from land drainage, and upstream river runoff, and from atmospheric diffusion. The concentration of carbon dioxide resulting in atmospheric diffusion will range from 0.4 to 1.0 milligrams per liter.

Because the uncontrollable inputs are highly variable, the contribution of carbon from artificial sources should not exceed the relatively constant input resulting from atmospheric diffusion. To maintain this level, the concentration of unstablized carbon in Escambia

Bay from artificial sources should not exceed 0.26 milligrams per liter. The average total organic carbon concentration in Escambia Bay is about 4.0 milligrams per liter.

The most important constituents of the nitrogen series which can be utilized quickly by algae are ammonia and nitrates. The Wacasassa Estuary in Florida, which is unpolluted by artificial sources of waste, has nitrate nitrogen concentrations of 0.03 milligrams per liter. The average concentration of ammonia plus nitrite-nitrate nitrogen in Escambia Bay is 0.49 milligrams per liter.

The amounts of phosphate required to stimulate algal blooms exceed about 0.01 milligrams per liter, in observed situations. The average concentration of total phosphate in Escambia Bay is 0.09 milligrams per liter.

I would now like to read the conclusions and recommendations of our report. First, the conclusions.

The entire upper section of Escambia Bay north of the L&N Railroad bridge is in a state of accelerated eutrophication as shown by unstable dissolved oxygen variations resulting from algal activity, high carbon, nitrogen, and phosphorus concentrations, and oxygen-demanding sludge deposits. Dissolved oxygen at the bottom of nearly half of the bay is less than the 4.0 milligrams per liter criterion established by the State of Florida for these waters. The closely spaced pilings under the L&N Railroad bridge adversely inhibits circulation, flushing, and exchange between the upper and lower bay.

In Mulat-Mulatto Bayou, dredging and filling for interstate highway construction and residential development in addition to the above conditions also contribute to degraded water quality. These conditions are the major causes of the numerous fish kills reported at Escambia Bay and Mulat-Mulatto Bayou during 1969. The lower section of the bay south of the L&N Railroad bridge also has degraded water quality primarily due to sludge deposits.

These water quality conditions in Escambia Bay and Mulat-Mulatto Bayou are caused by the discharge of carbonaceous, nitrogenous, and phosphorus wastes from the following sources in Florida: Escambia Chemical Company, American Cyanamid Company, Monsanto Company, the city of Pensacola Northeast Sewage Treatment Plant, and the Container Corporation of America plant in Alabama.

The total amount of pollution discharged from these five sources is more than 136,000 population equivalent of carbonaceous wastes, 651,000 population equivalent of nitrogenous wastes, and 135,000 population

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equivalent of phosphorous wastes.

The major discharges of carbonaceous wastes are the Monsanto Company, Container Corporation, and American Cyanamid. Escambia Chemical Company, American Cyanamid, and Monsanto Company are the principal contributors of nitrogenous wastes to Escambia Bay. Pensacola Northeast Sewage Treatmant Plant also discharges significant amounts of nitrogenous material. Monsanto Company and Escambia Chemical discharge most of the phosphorus although the Northeast Sewage Treatment Plant is also a significant source.

Container Corporation of America and the city of Pensacola Northeast Sewage Treatment Plant reportedly provide about 80 percent removal of their carbonaceous wastes at the present time. Furthermore, approximately four-fifths of the residual carbonaceous waste from Container Corporation is stabilized in the Escambia River before reaching Escambia Bay. American Cyanamid has a primary treatment facility. It is estimated that American Cyanamid removes about 37 percent of its carbonaceous wastes. Both Escambia Chemical and Monsanto provide no treatment to the waste effluents evaluated in this report.

American Cyanamid Company also discharges

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acrylonitrile. This compound is toxic to fish. Although it has not been directly demonstrated, the wastes from American Cyanamid could be directly responsible for some of the fish kills occurring in the north and northeast sections of Escambia Bay.

The heat discharged in the cooling water effluents from the Monsanto Company and Gulf Power Company is such that the temperature of the Escambia River is increased above the recommendations of the National Technical Advisory Committee to the Secretary of the Interior.

Benthic fauna in the Escambia River at the Alabama-Florida State line near Century, Florida, showed no significant damage from waste sources above the State line during the October 1969 field investigations. However, during extended periods of time, low flow in the Escambia River near Century, Florida, (as occurred in 1966 and 1968) wastes from upstream sources in Alabama degraded the habitat to a level sufficient to appreciably affect the diversity of the biota at the Alabama-Florida State line. Dissolved oxygen levels at the Alabama-Florida State line were above 4.0 milligrams per liter at all times during 1969.

Color in the Escambia River is increased from 70 units to about 120 units from Brewton, Alabama, to

Century, Florida. This color increase results from the discharge of treated industrial wastes from Container Corporation of America. Waste discharges to the Escambia River and Escambia Bay and the States of Alabama and Florida cause pollution which endangers the health or welfare of persons in Florida, and, therefore, are subject to abatement under the provisions of Section 10 of the Federal Water Pollution Control Act, as amended.

Recommendations: To reduce or eliminate the accelerated eutrophication of Escambia Bay and Mulat-Mulatto Bayou and to provide water quality suitable for a wide diversity of desirable uses, the following water quality management and waste abatement program is recommended: 1) Minimum reductions amounting to 94 percent carbonaceous, 94 percent nitrogenous, and 90 percent phosphorous wastes discharged to Escambia River and Bay from all sources. All waste sources provide complete removal of settleable solids. The allowable waste discharges from each of the major sources listed are included in the report.

The recommended alternative for accomplishing these objectives is the construction of a sewer collection system around the entire bay to intercept wastes from American Cyanamid, Escambia Chemical, Monsanto, and the

Northeast Sewage Treatment Plant as well as future and minor present effluents. This is consistent with the concept of metropolitan planning for waste management. All domestic and industrial wastes to be treated at a central facility with discharge away from Escambia Bay after the recommended carbon, nitrogen, and phosphorus reductions have been accomplished.

2) Color in the Escambia River at the Alabama-Florida State line, as measured at the Highway 4 bridge near Century, Florida, reduced to background levels measured above the Container Corporation of America discharge.

3) No further construction dredging permitted in Escambia Bay or Mulat-Mulatto Bayou until a plan for development of the shoreline has been established. At that time, construction dredging permitted only in accordance with this plan to be completed within one year by representatives of Escambia and Santa Rosa Counties, the city of Pensacola, the State of Florida, the U. S. Army Corps of Engineers, and the U. S. Department of the Interior. Any necessary maintenance dredging in the interim to be conducted by diking the dredging area. Maintenance of existing channels by hydraulic pipeline dredging only. Disposal of all dredged material to

upland spoil sites.

4) The Louisville and Nashville Railroad bridge across Escambia Bay to be rebuilt by not later than January 1, 1973, to eliminate the piling presently adversely affecting the circulation and exchange of water in the bay.

5) The American Cyanamid Company immediately reduce acrylonitrile concentrations in its waste effluent below 10 percent of the levels demonstrated to be toxic to fish.

6) The Monsanto Company and Gulf Power Company, by not later than January 1, 1973, abate the excessive heat being discharged in their respective cooling water effluents.

7) Century, Florida, install secondary waste abatement facilities and provide effective disinfection of wastes at all times.

Waste Abatement Schedule: Two alternatives are presented to comply with the waste abatement recommendations in this report. A central facility which will accept wastes from all sources in the Escambia Bay area for carbonaceous, nitrogenous, and phosphate removals or individual waste reductions amounting to at least 90 percent removal of carbonaceous material for each waste source, in addition to a central tertiary treatment facility designed for further carbonaceous reductions as well as nitrogen and phosphorus removal. Waste abatement facilities removing 90 percent carbonaceous materials must be completed and in operation by January 1, 1973, in order to comply with the implementation schedule set by the State of Florida. Alabama's implementation schedule specifies February 15, 1973, as the final date for completion and operation of waste abatement facilities.

Finally, Mr. Chairman, in conclusion, I would just like to recognize the cooperation and contributions of the various State, local and private organizations. Particular acknowledgements are due to personnel and students of the University of West Florida, and to the Bureau of Sanitary Engineering of the Florida Department of Health and Rehabilitative Services as well as the Florida Department of Air and Water Pollution Control, and the Alabama Water Improvement Commission.

Thank you.

MR. THOMAN: Mr. Traina, would you mind introducing the members of your staff who are here who are responsible for conducting this work?

MR. TRAINA: First, Mr. Thomas Gallagher, who directed the survey and analysis.

Mr. Lee Tebo, who directed the biological work on the river.

Mr. Paul Wagner, who was the engineer in charge of the survey.

Mr. Wade Knight, who performed most of the chemical analyses involving the toxic materials.

MR. STEIN: Thank you, Mr. Traina.

We are going to take a five-minute recess. I ask you to try to adhere to this because we have a lot of material that has to go in and we will ask you to be back in about five minutes.

(Short recess.)

MR. STEIN: Let's reconvene.

MR. REED: Mr. Chairman, I would like to introduce the Honorable Reubin O'D. Askew, a Senator from this district, and ask the Senator if he would like to say a word on behalf of the delegation.

STATEMENT OF THE HONORABLE REUBIN O'D. ASKEW, STATE SENATOR, ESCAMBIA AND SANTA ROSA COUNTIES, PENSACOLA, FLORIDA

MR. ASKEW: I have nothing to say in particular except that all of the members of the House delegation, as you know, conduct their committee assignments and meetings with a minimum of time, and so all of the House members are engaged in committee work in Tallahassee, and I am the only one here, but I want to declare to all of those present and to the official parties here of our interest in this area to do everything we can to help try to resolve all of these problems.

MR. REED: Thank you, Senator Askew.

I would like also to recognize a member of our Board, the Honorable John Roberts from Miami, who is here. John, would you hold up a hand? We are delighted to have you. You are a long ways away from home. Thank you, sir.

MR. STEIN: Thank you, Mr. Reed.

Would you come back to the lectern again, Mr. Traina?

Are there any comments or questions?

That indeed was a comprehensive report.

Mr. Patton.

MR. PATTON: Number one, you mentioned, Mr. Traina, the spacing of the pilings on the L&N bridge. Could you tell me what the spacing of the pilings are on the I-10 bridge which is immediately to the south?

MR. TRAINA: I will have to refer that to Mr.

Gallagher.

MR. GALLAGHER: We estimated that the I-10 bridge occupied less than 10 percent of the cross sectional area of the bay at that time and that the L&N Railroad bridge occupied more than 20 percent certainly.

MR. PATTON: One other -- not so much in the nature of a question as a comment, Mr. Chairman: I would suggest that Mr. Traina spell out, if he would, the relationship of the various forms of nitrogen compounds for our edification -- Kjeldahl nitrogen, ammonia-nitrogen, and nitrite-nitrate nitrogen.

MR. TRAINA: Spell out in relation to what?

MR. PATTON: How they are related, because they show up in different forms in the tables.

MR. TRAINA: I don't know if I fully understand your question.

MR. PATTON: For example, that ammonia is included in total Kjeldahl nitrogen but nitrite-nitrate nitrogen is not included in this.

MR. TRAINA: I see. I think maybe our chemist could come up and answer this question. Wade?

MR. KNIGHT: Mr. Traina, I didn't do the work.

MR. GALLAGHER: I believe your point was the total Kjeldahl nitrogen is the sum of the organic nitrogen as N and ammonia. That is total Kjeldahl nitrogen. Then, in that table as well, Table 2, they are separated. The TKN is given -- that is total Kjeldahl nitrogen -- and then ammonia is shown out of that because ammonia-nitrogen is a different compound.

MR. PATTON: But that does not include nitrite -- the Kjeldahl does not include nitrite-nitrate nitrogen?

MR. GALLAGHER: No.

MR. STEIN: Does that answer your question?

MR. PATTON: Yes.

MR. STEIN: Any other comments or questions?

DR. MYERS: This report is a comprehensive analysis of water quality problems in Escambia Bay and in view of the volume of data and the extent of discussions of these data, it should be obvious to each of us that one cannot without some concentrated study digest all of the information contained in this report. Certainly not within the time that we have had to review the document, the items contained in the report, since we received it first on Thursday, January 15 -- this is not a comment, it is mainly a matter of statement, and I know your problems.

There are some clarifying questions which we would like to raise so that we might know better how to consider this report and the recommendations that might be derived from it.

The first is the recommendation of 94 percent reduction of carbonaceous material discharged to Escambia Bay appears to be based on the necessity to contain the contribution of carbon from artificial sources within the level resulting from atmospheric diffusion.

Will you discuss this in more detail with regard to restricting the concentration of carbon from artificial sources to 0.26 milligrams per liter?

MR. TRAINA: Yes. The work that has been done recently both in laboratories and in the field has indicated that carbon is an important parameter with regard to eutrophication as are nitrogen and phosphorus.

Work recently done -- and a reference is made in this report -- by Keuntzel indicates that levels should be maintained at those that are contributed by atmospheric diffusion. This is a level which we know definitely that there will be no eutrophication providing the other parameters are kept to a minimum as well. These levels, as I indicated, range from 0.4 to 0.1 milligrams per liter, and the carbonaceous portion of that comes out to be 0.26, and this is how we arrived at those figures.

MR. THOMAN: Paul, were you citing any of

Keuntzel's work?

MR. TRAINA: Yes. Let me get this reference and maybe we just ought to enter that into the record.

DR. MYERS: While you are looking for that, I wonder: does this mean if this was a different area, this might be a different figure, too?

MR. TRAINA: Yes, on a mass basis, this is true, but in terms of the -- the levels that were used are theoretical levels that were developed by Keuntzel in this paper.

The reference -- let me just give that reference for the record. Kuentzel, and the title of the paper is "Bacteria, Carbon Dioxide, and Algal Blooms," Journal of the Water Pollution Control Federation, Pages 1737 to 1747, October 1969.

This particular reference is a summary of a considerable amount of work that has been done in recent years with relation to carbon dioxide to the eutrophication process.

DR. MYERS: Apparently the reduction recommended in nitrogenous materials is based on the attempt to reduce these materials in Escambia Bay to the concentration which has been observed in the Wacasassa Estuary in Florida.

Is this approach a sound basis, or are there other reasons for limiting the concentration to that observed in the Wacasassa Estuary?

MR. TRAINA: Again, our premise here was to reduce levels to amounts we knew that would not cause problems especially in the Florida water. Wacasassa Estuary study was a rather extensive one. It was being used by others in this regard and we used that as a level and applied it to this situation.

Again, it represents a level that we are confident would not cause problems.

DR. MYERS: What amounts of carbonaceous and nitrogenous materials and phosphorus can be tolerated in Escambia Bay from artificial sources, i.e., industries and municipalities? Are the quantities stated in the table on page 6, taking into account the reduction in 5-day BOD between Container Corporation's discharge and the bay, the maximums which can be allowed? If so, does this not mean that no additional discharges of waste can be made to Escambia Bay and, for that matter, Escambia River upstream as far as Brewton, Alabama?

MR. TRAINA: With regard to the question of tolerable limits, as I say, the basis of our recommendation was that we knew that at these levels we would not have problems. Now, we have made the recommendation or the suggestion -- let me be very clear on that -- the suggestion in the report that the ultimate solution for the problems of Escambia Bay should involve a central collection and treatment facility with discharge away from the bay.

We frankly feel that because of the nature of the bay, the physical nature of the bay, because of the development around the bay, that the ultimate solution of the problems of eutrophication both present and future in the bay should call for removal of all materials from this bay.

Now, with regard to the question of BOD, it was indicated in the report, and we made a point of it, that the contribution of BOD from the source in Alabama (the Container Corporation) is reduced by natural processes in the Escambia River, and that the contribution actually from that -- at the point in the bay -- only represents approximately 9 percent. However, in applying percent reductions, we applied these across the board to all cases so, therefore, the Container Corporation as well as the other plants have been recommended at the 94 percent removal of carbonaceous wastes.

DR. MYERS: On page 7 of the report, it is recommended that color in the Escambia River at Highway 4 near Century, Florida, be reduced to background levels measured above Container Corporation's discharge. On the basis of FWPCA data, it would appear that this means that Container must eliminate all color in its waste.

In this respect, it is stated on page 58 of the report that the FWPCA is sponsoring several research and development grants to develop a technically and economically feasible process for color removal. Have these research projects demonstrated a technically and economically feasible process for total elimination of color in pulp and paper mill waste?

MR. TRAINA: Let me answer the first question, with regard to the recommendation, page 7. The recommendation -- let me read it again -- is color in the Escambia River at the State line as measured at Highway 4 bridge near Century, Florida, shall be reduced to background levels.

Now, we took into account in this recommendation the dilution that you get from the streams between Container's discharge and Highway 4 bridge. So, therefore, in answer to your question: It would not be necessary to reduce or remove all of the color from this waste because you can take advantage of the dilution.

With regard to the research and development findings, we are sponsoring -- the FWPCA is sponsoring --

according to the information I have here, three such projects. Let me just perhaps read this; I think it would be pertinent.

A list of three plants that are currently using lime treatment in our area and the south central area are as follows:

1) Interstate Paper Company, Riceboro, Georgia. This project has been in operation for about two months. The project involves the stoichemetric treatment of paper mill wastes and utilization of a 650-acre stabilization pond for color removal and reduction of BOD.

2) Continental Can Company, Hodge Louisiana, is utilizing the stoichemetric lime treatment of kraft mill effluent in conjunction with carbonation to precipitate the remaining soluble lime for color removal.

3) International Paper Company at Spring Hill, Louisiana, is utilizing the massive lime treatment procedure for their kraft paper mill effluent for the reduction of both color and BOD.

These are going projects. There has been no definitive conclusions with regard to design, but they have shown that lime treatment is a way to go, but there have been no definitive conclusions made of any of these three research and demonstration projects.

DR. MYERS: Do we know how feasible these projects are going to be? Apparently from what you have said, do you know that at this time?

MR. TRAINA: Feasible from what standpoint?

DR. MYERS: Being able to remove this color.

MR. TRAINA: From a technical standpoint, it appears that they are feasible. We do remove the color, but again all of the information is not in. Other problems with regard to what you do with the sludge, and maintaining pH controls, and so on -- this is still under investigation, and we indicated this in the report.

DR. MYERS: Do we know anything about the economics of this?

MR. TRAINA: We do not have that kind of information at the present time -- the economics.

DR. MYERS: It is recommended that Container Corporation, along with all other sources of wastes below Container, reduce contributions of carbonaceous and nitrogenous materials discharged to Escambia River and Escambia Bay to the extent of 94 percent. Considering the voluminous quantity of water quality data on the Conecuh-Escambia River System between Brewton, Alabama, and Escambia Bay, does this data factually demonstrate that

Container Corporation is contributing carbonaceous and nitrogenous material to the Escambia Bay?

MR. TRAINA: At Escambia Bay, yes, sir. The information we found, as I indicated, we measured the effluents at the Container discharge. We estimated, based on information that has been available to us both on the river and in the areas, the amount of reduction in carbonaceous materials in the stretch between the discharge and the bay, and on that basis, the estimate is -- I have forgotten, but that number was given in the report -- at the bay, which is 80 percent less than it is at the effluent upstream of Brewton.

DR. MYERS: It is not quite clear in my mind just exactly how you have measured this.

MR. TRAINA: This was estimated, based on time of travel, deoxygenation, and we estimated an 80 percent reduction between the discharge point and Escambia Bay.

DR. MYERS: I see.

MR. STEIN: Are there any other comments or questions?

I would like to really compliment you, Mr. Traina and Mr. Gallagher, on the report. I think some of the people who have been following this business for a long time can recognize in this report how far we have come in pollution control analyses. I can see some people in the room and at the head table who remember the days if there wasn't a high coliform count or oxygen sag, it wasn't polluted. Today we have come up with entirely new methods of analyses and are very much more precise than we used to be. I take a considerable amount of pride in this, because some of the senior people who worked on this report -- and they are getting up to at least senior now; I have known them since they got out of school -- have provided answers and the kind of analyses to problems that we were looking for, but we just didn't have the scientific knowhow to get them. These boys have developed their careers to provide us with the answers.

I sympathize with some of the questions that Dr. Myers has been asking but, as I see this report, we have certain facts that possibly stand without dispute. One is the indication of the repeated fish kills in the Escambia Bay shows that there is something really seriously wrong with the system. The indications are but for the works of man, city, and industry this wouldn't happen. If this were just a bay, such as the one you used, the Wacasassa, this would be a perfectly normal operation in this part of the country.

Paul Traina

I think what the report has done is to lay out with particularity, chapter and verse, naming names and indicating the basis of the causal reaction of why this is happening, and this is something, of course, that the other people are going to have to respond to on a technical basis. I don't know whether they are telling it like it is, but they certainly told it to you with enough particularity so that if they are not, you should get the points on which they are not. If they are, they have given us a blueprint that we can move forward on.

Now, I think we have to recognize other factors. One, we have had an enforcement conference on the Escambia River in the past at the request of the State of Florida. I think, if I understood the report correctly, and I think I did, that four parts of oxygen are being maintained at the Alabama-Florida line in large measure with the material coming down, and this was the requirement that Alabama had at the time.

Now, what we are doing here -- well, for Alabama to come into the State of Florida -- in other words, Alabama is complying with the Federal-State agreement we arrived at years ago; that is, with Florida, Alabama and the Federal Government. The indications here in the report are this may not be quite enough on further analysis of the conditions.

Again, we have to point out that the paper corporation in Alabama, I think, is providing a considerable amount of waste treatment now, and it is not a case that that company hasn't applied itself.

Now, I think with all this new material, Dr. Myers -- I agree with you, and I was glad for your questions because I think possibly a couple of the formulations here may have been misinterpreted. I don't want to put words in your mouth. But this is what I think you meant, and please go over this: Particularly, I think this is epitomized by a statement on page 5 where you say the Wacasassa Estuary in Florida, which is unpolluted by artificial sources of wastes, has nitrate concentrations -- and you give a number -- and the average concentrations of ammonia plus nitrite-nitrate in Escambia Bay is -- and then you give another number -- how many times higher, several hundred?

MR. TRAINA: No, the difference is the 94 percent.

MR. STEIN: And it is a tremendous difference.

Then, you say -- and this may be a non sequitur as it stands -- therefore, a reduction of 94 percent of nitrogen material is required from all present and future waste sources.

Now, the point is just because this happens to the Wacasassa Basin doesn't mean that, ipso facto, you have to have it here. What I understood you to say is the Wacasassa Basin was pretty typical and you believe that this is the kind of thing that is required in Escambia Bay on your analysis of the conditions in the Escambia Bay. Is that correct?

MR. TRAINA: That is right. As I say, we feel certain at these levels, 0.03, that we will not have a problem at Escambia Bay, as they don't have a problem at Wacasassa, and this is what the basis was.

MR. STEIN: Now, I think this is the point. Because of the newness of the various portions in the report, Dr. Myers, I am not making a judgment on this. I think you can indicate that the basis, the thrust of this report is that their analysis indicates to the minds of the people who made it, that these remedial measures will result in an improvement in Escambia Bay. They are just throwing in the other places as examples. Is that correct?

MR. TRAINA: That is right. This will restore the quality of the bay.

MR. STEIN: Right.

MR. THOMAN: Mr. Stein, it gets back to simply this: There is no way that we can go back in history and measure the conditions that existed in Escambia Bay in an unpolluted situation. So we have to draw on comparable areas that are in that, and equate the present conditions here to what we know is an unpolluted estuary, and the Wacasassa was studied over a period of several years by a team from the University of Florida led by the late Dr. Saville. It was a very exhaustive survey.

MR. STEIN: Right.

I would just like to throw out one point again as an example. You people have probably heard of our pollution problems on the Potomac River. We do have treatment works there which are largely secondary treatment. This includes D.C., the States of Maryland, Virginia, the Interstate Commission on the Potomac River Basin and the Federal Government. And, again, we have come up with a very significant recommendation, looking for this nutrient removal on very high levels if we are going to preserve the estuary.

We have a similar problem on Lake Michigan and Lake Erie. But, I would like to point out, where you have this problem, in addition to primary and secondary treatment and chlorination of the effluent, we have asked for a significant amount of phosphate removal. So this is not peculiar, I think, to this situation.

In other words, it seems to me, this appears to be the approach: to deal with an estuary or a like problem where we are facing eutrophication, we are now approaching an era in which at least the scientific people are going to recommend, in addition to the traditional methods of treatment that we have faced before, that we achieve a significant amount of nutrient removal.

Yes, Mr. Patton.

MR. PATTON: Mr. Chairman, I would like to ask Mr. Traina a question.

If we had a magic wand and cut off all artificial sources of BOD, carbonaceous, nitrogenous, and phosphatic materials, in your opinion, would this mean there would be no more fish kills in Escambia Bay for some period of time?

MR. TRAINA: I think that is too simple an answer. As we indicated in the report, we have extensive sludge deposits in the bay; we have problems of circulation, or lack of circulation in the bay. So I think this is going to be a step-by-step procedure.

In looking at the information we had; in looking at the problems of the bay this past year especially, the first step seems to be the abatement of the artificial sources of waste plus the other recommendations we made.

To be specific -- and I think I indicated -- it has taken a long time to develop. It is obviously going to take a while to technicalize.

MR. PATTON: If you go to step one you would say step two would be to accelerate removal by some method of these materials?

MR. TRAINA: Those are going to have to be stabilized.

MR. STEIN: Again, let me give you the other experience because, Mr. Patton, this has happened again and again.

We have been able to, in some cases, and I think in significant cases, take this first step. Always the question is: What are you going to do about the sludge deposits that are left there? Now, again, sometimes, in this case, the cure may be as bad as the disease in stirring up the sludge deposits.

We have had Moriches Bay where you have in effect the same kind of -- you wouldn't call it an estuary -- flushing operation in the oyster area on the south shore of Long Island in Penobscot Bay, and in the

the Potomac River where we had significant sludge deposits and various other places. We have moved forward with the program but the decision was not to go ahead with a dredging program to clean up the benthic materials. In almost all cases we have found that in a marine situation where we had flushing, the recovery was much greater than the most optimistic scientific reports which tend to be tentative. They know they can stop something, but I can understand the scientists not wanting to predict they can improve.

By the way, we are faced with the same question on the Great Lakes, notably Lake Erie. For example, the question is always asked us: Okay, you can stop pollution of Lake Erie, but can you restore it? And no one wants to say we can restore it.

But let's see if we can get fair agreement on this — that unless we stop it we are never going to be able to meet that second-stage question of what do we do to improve it.

Are there any other comments or questions? If not, thank you very much, Mr. Traina.

MR. TRAINA: Thank you, Mr. Chairman.

MR. STEIN: Mr. Thoman.

MR. THOMAN: I have two Federal representatives that wish to speak. But first I would like to recognize five individuals from the Federal Government who are here.

Dr. Thomas W. Duke is representing the Regional Director of the Bureau of Commercial Fisheries, the U. S. Department of the Interior; and Mr. Jack Rosenall is representing the U. S. Geological Survey of the Department of the Interior. If you two gentlemen would stand up, please.

Lieutenant Commander Richard Hess is representing the Commandant of the Eighth Coast Guard District. Commander Hess, are you here? Thank you much.

Colonel Maret is the Deputy Commander of Eglin Air Force Base and representing that group here today. Thank you, Colonel.

And Dr. Albert Story, Chief of the Gulf Coast Technical Services Unit of the Public Health Service Shellfish Laboratory. Al, are you here? Good.

Next, I would like to call on Colonel Robert Snetzer, who is the District Engineer of the Mobile District Corps of Engineers.

Colonel Snetzer.

STATEMENT OF COLONEL ROBERT E. SNETZER, DISTRICT ENGINEER, MOBILE DISTRICT CORPS OF ENGINEERS, MOBILE, ALABAMA

COL. SNETZER: Mr. Chairman, conferees, ladies and gentlemen. I am Colonel Snetzer, Mobile District Corps of Engineers. I have a statement here on the Corps' activities in the area.

Work by the Corps of Engineers within the Escambia River Basin dates back to the 1880's. At present, the Corps of Engineers provide a 100-foot wide channel from the 10-foot depth in Escambia Bay to a point about 7 miles above the mouth of the Escambia River. Above that point no work has been done since 1882. Improvements in the lower 7 miles were completed in 1960.

At present, the Mobile District has two studies under way in the Escambia Basin. One is a navigation study resulting from requests by local interests for consideration of a navigation project to provide modern barge transportation to the vicinity of Andalusia, Alabama. It does not appear that a justifiable navigation project is likely. The other study under way is for flood control.

Col. Snetzer

The study area consists of the drainage basin of Big Escambia Creek, a principal tributary to Escambia River. The major flood damages on Big Escambia Creek occur at Flomaton.

There is a pollution problem in the lower portion of Big Escambia Creek caused by untreated sewage being discharged into the stream at Flomaton. Local authorities have plans for the installation of sewage treatment facilities to help alleviate this problem. Studies for this area will consider reservoirs for general flood control and related water-use needs and to channel improvements and levees and floodwalls for local protection. Consideration will also be given to non structural alternatives to reduce flood damages.

The only operations by the Mobile District within the Escambia Basin are the maintenance dredging of the lower 7 miles of the Escambia River and 5 miles into Escambia Bay. Maintenance dredging is required about every 2 to 3 years to keep the channel to its authorized 10-foot depth and 100-foot width. Occasional intermittent dredging of shoal areas is also done by Mobile District dredges.

Prior to undertaking maintenance dredging, investigations are made to determine if ecological

Col. Snetzer

changes have occurred, since the last dredging operation, which could result in damage by spoiling in either the existing or in newly designated spoil areas. Particular attention is directed to possible shellfish-producing areas to assure that spoil drift does not damage a shellfish bed. Close coordination is maintained with other Federal and State agencies to assure that the dredging will not adversely affect the aquatic environment.

Section 10 of the River and Harbor Act approved 3 March 1899 prohibits the placing of any structure in or over any navigable waters or excavating from or depositing material in such waters, unless the work covered by the permit has been recommended by the Chief of Engineers and authorized by a Department of the Army permit.

The determination as to whether a permit will be issued is based on an evaluation of all relevant factors including the effect of the proposed work on navigation, fish and wildlife, conservation, pollution, and the general public interest.

On pollution problems associated with dredging operations full coordination and collaboration with all appropriate Federal and State agencies is carried out.

This applies to the Corps' new work and maintenance channel dredging as well as to that of permittees for similar operations.

Under our procedure, copies of public notices on permit applications are sent to all interested parties and appropriate Federal and State agencies. Their comments are considered in the processing of permits.

In closing, I want to assure you that the Mobile District of the Corps of Engineers is continuously striving to develop our water resources for the maximum benefit of its many users, whether that use may be for flood control, navigation or water supply.

We are exerting considerable effort towards enhancing the water quality for fish and wildlife needs, to protect our shellfish-producing areas and provide for healthy recreation areas. The Corps of Engineers intends to continue its role as a full partner with other public agencies in a joint effort to protect our environmental resources.

Thank you.

MR. STEIN: Thank you, Colonel.

Are there any comments or questions?

Thank you very much.

MR. THOMAN: I would next like to call Mr.

R. H. Bair

Robert H. Bair, who is Special Assistant for Environmental Engineering from the Southeast Division Naval Facilities Engineering Command in Charleston, South Carolina.

STATEMENT OF ROBERT H. BAIR, SPECIAL ASSISTANT FOR ENVIRONMENTAL ENGINEERING, SOUTHEAST DIVISION NAVAL FACILITIES ENGINEERING COMMAND, CHARLESTON, SOUTH CAROLINA

MR. BAIR: We in the Navy didn't really plan to make any formal statement, but we were requested just before the meeting to summarize what our program is, and so I will make this a rather brief statement.

We feel that the Navy has a pretty good handle on the waste disposal problem including industrial and domestic wastes in the area, and essentially it amounts to this: There is about a $1.25 million project that is under way at the Naval Air Station at Pensacola for the treatment of industrial wastes, and also a project was put out for bids yesterday for about $700,000 for secondary treatment at the same place, at the Naval Air Station at Pensacola, making a total of about $2 million of hard-to-come-by Defense dollars these days.

There is another $2 million of projects which are what we might say in the planning stage at Saufley Field, at Corry Field, and at Ellyson Field. Now, actually -- I will correct this -- at Ellyson Field, we have recently completed connection to the city of Pensacola and we think that this is probably the more logical approach for the other two fields at Saufley and Corry, so the city is in the process of studying this approach as to what kind of a proposal they might be able to make to the Navy.

These plans for these projects have been approved both by the State and the Federal Water Pollution people as complying with their respective pollution control regulations, and it is the Federal and the Navy policy to cooperate completely with these agencies, on following Executive Order 11288.

Of course, our major problem from now on is the matter of operation, and so we plan to work further with these agencies and develop an orderly operation of these plans to continue to meet these Federal standards and State standards.

MR. STEIN: Are there any questions or comments?

MR. THOMAN: Did I understand you correctly, Mr. Bair, that the Navy and the city of Pensacola are actively negotiating at this point in time for connection of two additional fields, or three additional fields to the city system?

MR. BAIR: It is planned to -- we have approached the city on the possibility of two additional fields. We have a firm agreement and contract and we have completed the construction of one field, Ellyson Field. The two other fields that I spoke of, Corry and Saufley, we have approached the city, and they are in the process of studying and will give us their proposals, we hope, before long.

MR. STEIN: What are Corry and Saufley doing with their wastes now?

MR. BAIR: Each of these two fields has a complete sewage treatment plant. We are, though, faced with major -- possible major expansion of Corry Field, particularly to take care of housing -- future Navy housing -- in that area; and Saufley Field is also maybe faced with the problem of increasing the size of its plant. So we have this alternative --

MR. STEIN: I assume you don't have nutrient removal at these plants.

MR. BAIR: This is correct; not as such. This is, of course, I think, more or less a development that we are including in the projects -- we will include in these projects.

MR. THOMAN: Were these plants built during the Second World War?

MR. BAIR: That is correct.

MR. THOMAN: In other words, they are about ready to be retired.

MR. BAIR: Let's put it this way: They are in good physical condition and are producing good results. I won't say particularly, since they were built during World War II, that they need to be retired any more than I need to be retired.

MR. STEIN: Well, you look like me, that we were built considerably before World War II.

MR. BAIR: Thank you.

MR. STEIN: As a matter of fact, I was built so well before that, that they used me for four years. I don't think I could pass the physical now.

I hate to break the sad news -- I am glad the Colonel is here -- but I think if we are going to ask the kind of remedial program we are asking here, the one omission in the Federal report was the lack of Federal installations, and I think that we are going to have to have a commensurate program certainly on the nutrient removal from Federal installations as we are going to have from any city or industry in the area.

MR. THOMAN: Mr. Stein, there is no discharge into Escambia Bay from any Federal installation.

MR. STEIN: There is no discharge into this bay from any Federal installation?

MR. TRAINA: Ellyson, but that is connected to the city and we mentioned it in the report.

MR. BAIR: We recognize there is need for more complete treatment. We also recognize this is an area problem. The Navy has a more economical approach, so they can more benefit from a more economical solution to this problem of algal bloom, and so forth.

MR. STEIN: Right.

MR. THOMAN: Thank you very much, Bob.

MR. STEIN: Thank you.

Are there any other comments or questions? Thank you very much.

Let's stand recessed for lunch until --

MR. REED: I would like to be able to call on Mr. William Law, who has a short presentation. If we could have the city manager of Pensacola, Mr. William Law, give his presentation now; it is short and he has commitments this afternoon.

STATEMENT OF WILLIAM H. LAW, CITY MANAGER, CITY OF PENSACOLA, FLORIDA

MR. LAW: Mr. Chairman, conferees, ladies and gentlemen.

I would assume, of course, by virtue of the fact that we did connect Ellyson Field immediately prior to the beginning of the study or in the process of the study, that we would consider ourselves to be in the position of defending what the Federal Government might have been doing had the connection not been made. I would want to make this point right in the very beginning, and I think this is crucial from the city of Pensacola's point of view.

We certainly are in favor wholeheartedly of pollution control. We will continue to devote a good deal of time and effort and money to the cause of correcting pollution. However, I think it is obvious that in order to do this requires that standards be set. Our impression, at this particular moment, is that the city is meeting all of the State standards that have been previously published, and I would hope that in the event this conference develops into setting new standards that these would be acceptable to all Federal agencies and, of course, to all State agencies including the Board of Health, because we have a peculiar situation of having two State agencies involved with the same particular problem.

Now, I have previously given a copy of my report to the conferees, and I would like to just touch on a part of it.*

On page two, we make note at the end of the second paragraph that generally the report is believed to be factually correct. However, it is believed that a few inaccuracies may be pointed out. These include:

1. Table 2, unnumbered pages following page 23 under V. Waste Discharges, refers to flow for the northeast Pensacola Sewage Treatment Plant as 1 million gallons per day. The actual recorded flows for this plant commencing in early September 1969 and since varies from 500,000 to 600,000 gallons per day.

This plant carried a load of about 300,000 prior to those connections which was immediately before the study.

This in turn affects all of the other values reflected in Table 2 that pertain to this plant. If we

*(See Page 277a for statement in its entirety.)

W. H. Law

refer to Tables 2 and 3 under V. Waste Discharges, we find that the value of 457 pounds per day represents 2.7 percent contribution of the total 5-day BOD, but if it is corrected to the actual contribution of 70 pounds per day, this would be a fractional part of one percent only and would indicate that this plant is not a significant contributor, even in the framework of this report let alone the current requirements of the State.

2. Sampling, as reflected in Appendix II, page 3, shows that the method of effluent sampling was by grab sampling and that five samples were collected for the 10-day period. Because of the varying peaks encountered with municipal sewage flows and their very heterogeneous nature, unless a schedule of 24-hour composite samples is followed, random samples may not accurately reflect the true average character of the effluent from that source. We would offer to our own personnel certainly the facilities of the plant to allow such 24-hour composite samples to be taken if you should so desire.

Waste from the Westinghouse Plant was received commencing on 5 September 1969, and from NAS Ellyson commencing on 14 September 1969. It is to be expected during the startup of any facility of this type that there will be some initial problems. It is also unfortunate

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that the sampling period of 10 through 20 September 1969 coincided with this initial startup phase that included the receiving of wastes from these two significant sources.

Over on page 4, it was necessary for the city to place these sources on notice with respect to the quality of the waste being received, and as a result of that, these contributors apparently did accomplish certain corrective measures and the quality of effluent from this treatment plant for the month of December 1969 indicates that it has been reestablished to acceptable levels.

The conclusions establish rather idealistic recommendations that include minimum reductions amounting to 94 percent for carbonaceous wastes, 94 percent for nitrogenous wastes, and 90 percent for phosphorus wastes to be discharged to Escambia River and Bay from all sources.

In addition, all waste sources should provide complete removal of settleable solids. It would appear that these percentages, if followed in a waste abatement program as recommended, would mean that the Northeast Sewage Treatment Plant, which has been acceptable by the Florida Department of Health and Rehabilitative Services up to the present time is now a completely obsolete facility, and it should be remembered that these standards are in excess of the existing ones.

Review of this study indicates that considerable emphasis is being placed upon nitrogenous and phosphorous substances included in the effluents. Just for a little emphasis, and to try to take the pressure off this particular area, I noticed in the January-February issue 1970 of the Florida County Governments that in the Alpha -- I think that is correct -- Alafia -- they are putting in 200 pounds per mile of phosphates down there.

On page 5, we make note of the fact that if this emphasis applies to quality control of effluent hereafter for sewer treatment plants, then all of the existing trickling filter plants in the State would probably need extensive modification, and that is obviously a significant funding problem.

If these recommendations are implemented -- and I don't say that they shouldn't be; I am merely trying to point this out as a highlight to the city -- it should be supported by a funding program of considerable magnitude that would include Federal and State participation.

We feel too this industry located in the State of Alabama should be required to achieve the same quality levels that are applicable in the State of Florida.

It is then considered if the recommendations of this report be implemented, the matter of planning and funding becomes a serious problem with respect not only to this municipality and its Northeast Sewage Treatment Plant in particular, but to other municipalities in the State of Florida as well. Provision must be made for participation in funding where municipalities are involved.

It would be my impression that if the major recommendation that a trunk line be installed and that a major facility be provided to provide for tertiary treatment, that we would use up all of the tax funds available to the city of Pensacola to finance such an activity. I would, therefore, recommend to you that if you do decide that tertiary treatment is the proper level of treatment that for those who are capable of providing it themselves they be allowed to do so rather than participate in a trunk line that is going to run completely around the bay, because we would be able to put in that third unit, I think, at a much lower cost than a percentage of such a proposal.

I think that pretty well summarizes my position and the city's position on this matter. I would like to believe that we have tried to do what the State and good conscience would dictate prior to this point, and we would want to do that very same thing in the future. If the standards are changed and seriously altered, we would fervently request that the Federal funding be proportionately increased and that the State funding be started.

Thank you very much, gentlemen.

MR. STEIN: Thank you.

Are there any comments or questions?

MR. THOMAN: I have got a couple.

What is the capacity of that plant?

MR. LAW: A million gallons a day, as it stands today.

MR. THOMAN: In other words, you are eventually going to get up to that level.

MR. LAW: It will be an extremely long period of time before we could.

MR. THOMAN: I wanted to make a comment at this point in time, and that is that I don't know whether Mr. Traina hammered home the point well enough or loud enough on this thing. But there isn't really an allowable amount of these materials that can be discharged into Escambia Bay and prevent polluted conditions. And if you want or if the city of Pensacola and Escambia and Santa Rosa Counties expect to continue their development, there isn't going to be an allowable load that can continually be impositioned upon the bay; otherwise you will have the conditions the same as they are now, which was the reason for the recommendation that there be eventual complete removal of the waste effluents from the bay.

Now, this is, in fact, a rather new concept. It is one that we had entertained in connection with the production of another report on Tampa and Hillsborough Bay, but we seem always to get to the inescapable conclusion that these highly sensitive estuaries just cannot take too much imposition of man-made pollution and still continue to exist for a wide variety of water uses.

Now, this is true. It is something that is new, and it is something that is in the development stage, and whether or not these conferees will recommend that I don't know. This is something that has to be determined, and it is part of a planning process for the city, and the counties, and industries.

MR. LAW: I certainly want to encourage in that review, but I want to emphasize the fact again to those of the public who may not be alert to it: We are talking about the academic situation of what would be desirable rather than the standards and the criteria that are set forth today. I have put it to you gentlemen that I would have negotiated with the Federal Government and with Westinghouse on an altogether different plane if you had established these criteria two months prior to our contract.

MR. STEIN: Mr. Patton.

MR. PATTON: One thing I would like to point out: that we expect to hold a hearing in Tampa probably on the twenty-fifth of February of this year to consider the problems of the Alafia River and Hillsborough Bay, if we can get legal publication in time. It will be around that time. It depends upon the schedule that we can meet.

Number two, we are very much aware at the State level of the problems that financing poses for secondary as well as tertiary treatment, and we hope that we will be able to present something to the legislature at the forthcoming session to provide State participation and assistance in this matter.

MR. REED: Exclusive of school bonds, what is the city's bonded indebtedness at this time?

MR. LAW: Collectively?

MR. REED: Exclusive of school bonds.

MR. LAW: Approximately $27 million; that is within give-or-take a million dollars.

MR. STEIN: Mr. Law, what is your water bill?

MR. LAW: You mean revenues?

MR. STEIN: Yes. Do you charge?

MR. LAW: We run a system both in and out of the city as we do of the sewer operations, and the revenue from the utility and water we hope this year will reach $2 million. I think it has been $1.8 million.

MR. STEIN: How much was the rate?

MR. LAW: In the city a maximum of $2.50 and out of the city $4.

MR. STEIN: Okay. A month, then?

MR. LAW: Yes, sir.

MR. STEIN: Now, we have been through this before and I don't want to do this in a backward way, but since Mr. Reed raised this question, I think if you live in a metropolitan area and you are looking for clean water, and we are getting to the analysis that we have now, you are not going to get business with a $2 or $4 bill for water and pay $25 or $30 for electricity or a like amount for your telephone. The water bill and the sewer charge are just going to have to go up, and I think this is inevitable.

Now, the point is, Mr. Law -- and I am fully sympathetic and in agreement with what you say, but let's analyze what went on here and just repeating -- you said basically you are in agreement with the report.

MR. LAW: The concept of the report, not the report itself, because we do think it poses a difficult problem for the city in regard to the sampling.

MR. STEIN: In the concept of the report.

Now, the basic issue in this report, as I see it, is this -- or the basic finding is this: that if the cities and the industries continue putting these nutrients in your estuary you are going to have these repeated fish kills, and you are going to have what we consider and the State considers, and I suppose everyone else considers to be a polluted body of water. If you don't want that polluted body of water, you have to stop this.

Now, the question, I think -- and Mr. Thoman alluded to this -- is that the city would have to consider this in its planning or moving forward. But we have more to it than this, and you say why weren't we here a few months ago. The point is: We have to develop a report, and very probably when we are dealing with an interstate situation, we have to wait on the Governor's request and we have it here. But I think this notion of local rights, State's rights and Federal rights are long gone in this field. If we are going to protect our resources, we all have to work on this together.

Now, if we have this basic concept of this report -- and here is the thing I want to emphasize and I am not prejudging this situation at all -- but if we

Murray Stein

are accepting the basic concept of the report, that we have to do something about nutrient removal, i.e., nitrogenous material, carbonaceous material, phosphates, from the wastes, in order to keep these waters up to a water quality where they will support the maximum number of uses and they will not be polluted, then we have to expect everyone, whether they are industries or municipalities, to comply with that. Admittedly this is going to be more expensive. As far as I understand municipal operations, and this depends on your point of view, it's not that much more expensive.

The question of whether we go into a joint system, collective system, or you go into it individually is largely a matter of planning and economics, and the details we can work out. But I think the inescapable operation is that if we accept this report right at this meeting -- don't talk about standards or something that is coming out in another guise -- right at this meeting, right as the result of this conference, our job or the panel's job here -- and I hope you will participate with us -- will be to set the requirements for a clean Escambia Bay.

Now, the problem we have under our system of government -- this is not just a judgment any more for the cities and the industries bordering the bay -- because I think the State and we right now both have a legal obligation: We have to provide that, otherwise we are not doing the job that we were sworn to do under our oaths of office. We have to do this.

Now, what we are asking here if again the concept of the report is correct, is that we want to come to an agreement on whether we can accept this and its recommendations and whether we can all work forward to its conclusions. If we can't, or if there is anything wrong with this in the concept, of course, we are going to keep this meeting open until we get all of the views in order to determine where to go.

But what I want to point out is the time is now. You are not going to get another standards-setting or other operation. The results of this group are going to set this and if anything is to be said, I think this is the group to say it to.

MR. LAW: The thrust of the report, of course, is well founded in terms of its concern with pollution. Our examination of the data submitted within the report indicates that at least in the case of the city of Pensacola, the data reflected lack of consideration on the actual flows involved, and our percentage of pollution is below what apparently was previously said is acceptable from the State of Alabama.

So we are not polluters of the bay except in the technical sense we are; there is no question about that. I think it has to be obviously admitted. But, on the other hand, if we decide to establish the new standards as the result of the conference, I would trust in your good judgment in that regard. But if you elect to take tertiary treatment I would say that perhaps this particular scheme of approach might not be as realistic as some other measures, and it seems to me that we could consent to tertiary treatment at the Northeast Plant and accomplish it for a lot less dollars than what is proposed.

MR. STEIN: By the way, I am not arguing that with you, but I think first we have to come to an agreement of whether what you call tertiary treatment is what we are going to require from all hands. Once we decide on that, I agree, then, we have the alternate methods, and I make no judgment on what we are going to require. But once we decide where we go forward, if it is felt that your plant that you just got into operation does not meet the requirements that are necessary to protect the Escambia Bay from its polluted condition, then the alternative method is something that we would have to discuss.

Now, I suspect, again, though that this panel will discuss that as well. So we can get the program off as fast as we can, because, again, long before I came here, sir, and just reading the papers, I think it is pretty clear you have a very critical pollution situation in these waters, and that something has to be done, and we have to start.

MR. LAW: Well, that is my point, sir. I think that we have to observe the actual facts rather than what is put into the newspaper or rather what is put into this report, and it would indicate that we are at the level of something less than one percent at present and hopefully we try to arrive at that as a goal in the future. I can't dispute with you the idea that any effluent from the sewage treatment plant regardless of its percent of culpability wouldn't be a polluter --

MR. STEIN: You are not suggesting that the actual facts did not appear in the newspaper or in this report, are you?

MR. LAW: Yes, I sure am. Only because of the fact that the report indicates the plant is designed at a million gallons. It is carrying a flow of a million gallons. In fact --

MR. STEIN: What about newspapers?

MR. LAW: Well, on a couple of occasions, I think there were stories written about the pollution problem and some of the facts did get to be changed around from what I understood them to be.

MR. THOMAN: Mr. Law, as a city executive, you are naturally concerned about money and how you are going to pay for things and rightly so because this is your job. At the same time, though, I don't think that this body is going to come up with anything that there has to be built a peripheral interceptor sewer and dump it out in the bay. Maybe they will; I don't know. But you may have missed my point before that you can't continue to put industry into the Pensacola area that continually adds increments of carbon, nitrogen, and phosphorus into the system and expect it to be an unpolluted system. Now, this is something that just cannot happen. This is the same thing that is true in Tampa-Hillsborough Bay, that it is beyond adding any more to it. Even that 200 pounds per mile which we are hoping that Mr. Patton and his group will address themselves to that problem with alacrity.

Thank you much.

MR. LAW: Okay.

MR. STEIN: Are there any further comments or questions? If not, thank you very much.

MR. LAW: Thank you, gentlemen.

MR. STEIN: Now, if there is nothing more, let us recess for lunch and let's try to be back here about half past one.

We stand recessed.

(Noon recess.)

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THE CITY OF PENSACOLA FLORIDA

19 January 1970

Honorable Claude Kirk
Governor
State of Florida
Tallahassee, Florida

Honorable Walter J. Hickel
Secretary
United States Department of the Interior
Washington 25, D. C.

Subject: Report of Effects of Pollution on Water Quality,
Escambia River and Bay, Florida, Dated January 1970

Gentlemen:

The subject documentary is a result of studies conducted in September and October 1969. This study deals primarily with an investigation of waste sources in Florida and Alabama in the Conecuh-Escambia River watershed area downstream of Brewton, Alabama and Escambia Bay near Pensacola, Florida, in particular. The report deals with an evaluation of interstate and intrastate pollution within the area named and presents an evaluation of data collected during the studies. This report was developed by the Federal Water Pollution Control Administration, U. S. Department of the Interior, Southeast Water Laboratory, Technical Services Program, Athens, Georgia.

The subject report has been read with interest by representatives of the City of Pensacola, Florida, since one of the waste contributors discussed in the report is the Northeast Sewage Treatment Plant

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belonging to the City of Pensacola, Florida. The report is quite voluminous and presents a wealth of material, as well as conclusions and recommendations. The authors of this work are to be congratulated on developing such a learned study report in a remarkably brief span of time.

Our remarks concern themselves only with the Northeast Sewage Treatment Plant and the report in general, since the City has had but a very few days to make but a brief and cursory review of this document. Generally, the report is believed to be factually correct. However, it is believed that a few inaccuracies may be pointed out, these include:

1. Table 2, unnumbered pages following Page 23 under V. Waste Discharges, refers to flow for the Northeast Pensacola Sewage Treatment Plant as 1,000,000 gallons per day. The actual recorded flows for this plant commencing in early September 1969 and since varies from 500,000 to 600,000 gallons per day. This in turn affects all of the other values reflected in Table 2 that pertain to this plant. If we refer to Tables 2 and 3 under V. Waste Discharges, we find that the value of 457 pounds per day represents 2.7% contribution of the total five-day BOD, but if

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corrected to the actual contribution of 70 pounds per day would be a fractional part of 1% only. This would indicate that this plant is not a significant contributor.

2. Sampling, as reflected in Appendix II, Page 3, shows that the method of effluent sampling was by grab sampling and that five samples were collected for the ten day period. Because of the varying peaks encountered with municipal sewage flows and their very heterogeneous nature, unless a schedule of twenty-four hour composite samples is followed, random samples may not accurately reflect the true average character of the effluent from that source.

Waste from the Westinghouse Plant was received commencing on 5 September 1969 and from NAS Ellyson commencing on 14 September 1969. It is unfortunate that the waste from both of these sources contained excessive oil and greases. It is to be expected during start-up of any facility of this type that there will be initial problems. It is also unfortunate that the sampling period of 10 through 20 September 1969 coincided with this initial start-up phase that included the receiving of waste from these two significant sources. Prior to time of receipt of this effluent from these two sources, the quality of the effluent from the Northeast Sewage

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Treatment Plant averaged over 90% reduction of BOD_5. It was necessary for the City to place these sources on notice with respect to the quality of the waste being received. As a result, these contributors apparently did accomplish certain corrective measures and the quality of effluent from this treatment plant for the month of December 1969 indicates that it has been re-established to acceptable levels.

The conclusions establish rather idealistic recommendations that include minimum reductions amounting to 94% for carbonaceous wastes, 94% for nitrogeneous wastes, and 90% for phosphorous wastes that are discharged to Escambia River and Bay from all sources. In addition, all waste sources should provide complete removal of settleable solids. It would appear that these percentages, if followed in a waste abatement program as recommended, would mean that the Northeast Sewage Treatment Plant, which has been acceptable by the Florida Department of Health and Rehabilitative Services up until this time, is an obsolete facility. Stated differently, considerable expense would be required in order to effect plant modifications that would accommodate these recommended standards. It should be remembered that these standards are in excess of the existing State requirements.

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Review of this study indicates that considerable emphasis is being placed upon nitrogeneous and phosphorous substances included in the effluents. Municipal sewage treatment plants, generally, as well as the Bureau of Sanitary Engineering of the Department of Health and Rehabilitative Services, have emphasized the reduction and removal of carbonaceous substances. This report seems to indicate that the nitrogeneous and phosphorous substances are, primarily, contributed by the industries involved. There is a small contribution of these substances by the Northeast Sewage Treatment Plant. However, historically, an evaluation of the effects of nitrogeneous and phosphorous substances have not previously been reported to or stressed by the Florida Department of Health and Rehabilitative Services.

If this emphasis applies to quality control of effluent hereafter for sewage treatment plants, then the existing trickling filter plants in the State would very probably need extensive modification. The order of these is indeterminate at present but, applied on a statewide basis, it is considered that the funding necessary would be considerable.

It is interesting to note that this plant was constructed and placed in operation in 1962 and that, based upon the recommendations in this report, it is conceivable that it may now be an obsolete facility. If this is true, then these recommendations should be supported by a funding program of considerable magnitude that would include Federal and State participation. It should be pointed out too, that the industry located in the State of Alabama is required to achieve qualitative levels that are considerably less than those for industry or sewage treatment plants in the State of Florida. Yet, the Alabama based industry is one of the major contributors of waste to the Conecuh-Escambia River and ultimately Escambia Bay.

It is considered that if the recommendations of this report are implemented, then the matter of planning and funding becomes a serious problem with respect to not only this municipality and the Northeast Sewage Treatment Plant in particular, but other municipalities in the State of Florida as well. Therefore, if this report is implemented, then provision must be made for participation in funding where municipalities are involved. The report is idealistic with respect to the area where tertiary treatment is recommended, certainly with respect to municipal contributors where the quality of waste discharged would be of an insignificant or negligible value.

Sincerely,

City Manager

277g

cc: Mr. John R. Thoman, Regional Director
Southeast Region
United States Department of the Interior
Federal Water Pollution Control Administration

cc: Florida Department of Air and Water
Pollution Control

cc: Bureau of Sanitary Engineering
Florida Department of Health and
Rehabilitative Services

cc: Dr. Thomas Hopkins
University of West Florida

cc: Alabama Water Improvement Commission
Montgomery, Alabama

TUESDAY AFTERNOON SESSION

- - -

MR. STEIN: Let's reconvene.

We will now hear from Florida, Mr. Reed.

MR. REED: Mr. Patton, if you will present the Florida testimony, please.

STATEMENT OF VINCENT D. PATTON, EXECUTIVE DIRECTOR, FLORIDA DEPARTMENT OF AIR AND WATER POLLUTION CONTROL, TALLAHASSEE, FLORIDA

MR. PATTON: Thank you, sir.

The Florida Department of Air and Water Pollution Control is pleased to have this opportunity to participate in a discussion of the water quality problems of the Escambia River and Escambia Bay.

A number of citations has been issued to water pollution sources, both domestic and industrial, throughout the State of Florida. Mr. de Castro will present more specific details shortly. He will indicate enforcement actions pending in this area. Another speaker, Mr. Huffstutler, will present a brief outline of planning actions under study, and hopefully which will be under way on a larger scale in the not too distant future.

V. D. Patton

The Federal Water Pollution Control Administration report which has been presented resulted from a request by the Governor for assistance in providing greater detail on sources of pollution discharging to the Escambia River and the Escambia Bay. We feel the Federal Water Pollution Control Administration is to be complimented for their work.

The predecessor of this Department, the former Florida Air and Water Pollution Control Commission, held a hearing in Pensacola, on May 21, 1969, and at that time the former State Board of Health presented a report which brought out certain highlights of the situation. I believe that this coupled with Dr. Hopkins' work, presented to the Escambia-Santa Rosa Water Pollution Task Force, October 8, 1969, and the report of FWPCA conclusively shows the magnitude of the problem.

The Department staff is carrying out additional work at this time to attempt to determine if any damage or harm is being caused to the Escambia River and Escambia Bay by discharges of heated water. Unfortunately, the work has not been concluded and no results are available for presentation at this conference.

Pensacola's Northeast Treatment Plant has been tested. The results were such that a citation is being prepared as the next step in the corrective process.

Work has been started which will provide useful information to both divisions and several bureaus of this Department. The portion completed to date is shown in the attached document. This will be refined and upgraded.

Mr. Chairman, this has been passed out to you. It is a brown colored volume. This is the work county by county to show the sources of pollution, their location, the amount of waste, and this is utilizing the inventory of the State Board of Health, the FWPCA's 1966 status report plus additional information.

MR. THOMAN: Mr. Stein, may we incorporate the report pertaining to Escambia County into the record?

MR. STEIN: Without objection, that will be done.

MR. PATTON: There is also one on Santa Rosa County which will complete this.

MR. STEIN: Both of those will be placed in the record.

MR. PATTON: Thank you, sir.

(The documents above referred to follow.)

A Cursory View of Some Waste Treatment Plants and Future Needs for Selected Areas in Florida.

Maps of the Northwest Florida area (by county) and Broward County are included with the locations of sewage treatment installations. These installations as well as industries under citation have been placed on an overlay for use with the base (county) map. Sewage treatment installations which are also under citation are marked with an asterisk.

The installations are listed in relation to their corresponding number on the location overlay. Data included on the list are name of system, average daily flow (ADF)-either actual measured values or designed values when measured values are not available (N.A.), population served or population equivalent, type of treatment, and receiving stream. Data was obtained using FSBH 1966 Inventory of Public Sewerage Systems, the 1968 Final Inventory of the FWPCA, Water and Wastewater Study for Broward County, May 1969, and information and a location map of Broward County.

Estimated costs for treating all county residents were calculated for each county in Northwest Florida and also for Broward County. These costs were based on the estimated 1970 population data taken from page 23 of Florida Statistical Abstract 1969. Current population being served and average daily flows were totaled for each county, and an average gallons per capita per day (gpcd) figure was derived. Current population being served was then subtracted from estimated 1970 population to arrive at a population yet to be served. Using this figure and the gpcd for the county, a total gallons per day figure was derived. Using the figure $0.50 per gallon per day as the average cost of treatment alone (obtained from Mr. Dave Scott), the total treatment costs were obtained. However, this cost is only about 1/10th the total cost of providing the complete service of collection and treatment so the value obtained was increased by a factor of 10 times. This final figure then represents the total dollar value at this moment to provide complete service for all county residents. This estimate of course is a conservative one since other factors will influence the cost, such as increasing costs, using trunk sewers over large distances to a central treatment plant, and upgrading and addition to existing plants (especially those with primary treatment only). The figure does, however, in the case of Broward County, compare favorably with estimates of the Broward County Engineer and Study of Broward County Water and Wastewater, May 1969.

Maximum possible Federal Aid under PL 660 (if a planning council is in existence with a plan for implementation of funds) is 33% of total cost of construction. These values were also calculated for each county concerned. Current PL 660 requests were also compiled for each county (ie requests for FY 69 and FY 70).

All of this cost information has also been included on the overlay in order to show the large amounts yet needed through PL 660 requests as well as from other than Federal sources, be they bond issues, increased taxes, etc.

Escambia County

I. Sewage Treatment Installations

Number	Sewage System	Actual or Designed Average Daily Flow(ADF)inMGD	Population Served or Population Equivalent	Type of Treatment	Receiving Stream
1	Scenic Hills County Club S/D (Pensacola)	0.020	200	Septic Tank	Thompson Bayou to Escambia River to Escambia Bay
2	University of West Florida	0.125	1250	Extended Aeration	Escambia River
3	Carrollwood S/D	0.040	400	N.A.	Thompson Bayou to Escambia River
4	Ellyson Field NAS (Pensacola)	0.125	1250	Trickling Filter	Escambia Bay (Submerged Outfall)
5	City of Pensacola (Plant #3)	0.84	8400	Trickling Filter	Escambia Bay (Submerged Outfall)
6	Lincoln Park S/D (Pensacola)	0.025	200	Contact Stabilization	Eight Mile Creek to Eleven Mile Creek to Perdido Bay
7	Wedgewood S/D	0.004	40	Trickling Filter	Pond to Bayou Marcus Creek to Perdido Bay
8	Saufley Field Mainside NAS	0.21	2100	Trickling Filter	Perdido Bay (Submerged Outfall)
9	Mayfair S/D (Pensacola)	0.650	5600	Trickling Filter	Bayou Marcus Creek to Perdido Bay
10	Montclair S/D	0.263	1600	Trickling Filter w/Pre-Aeration	Bayou Marcus Creek to Perdido Bay
11	Avondale S/D (Pensacola)	0.070	700	Primary	Bayou Marcus Creek
12	Devonshire S/D (Pensacola)	0.017	100	Extended Aeration	Bayou Marcus Creek

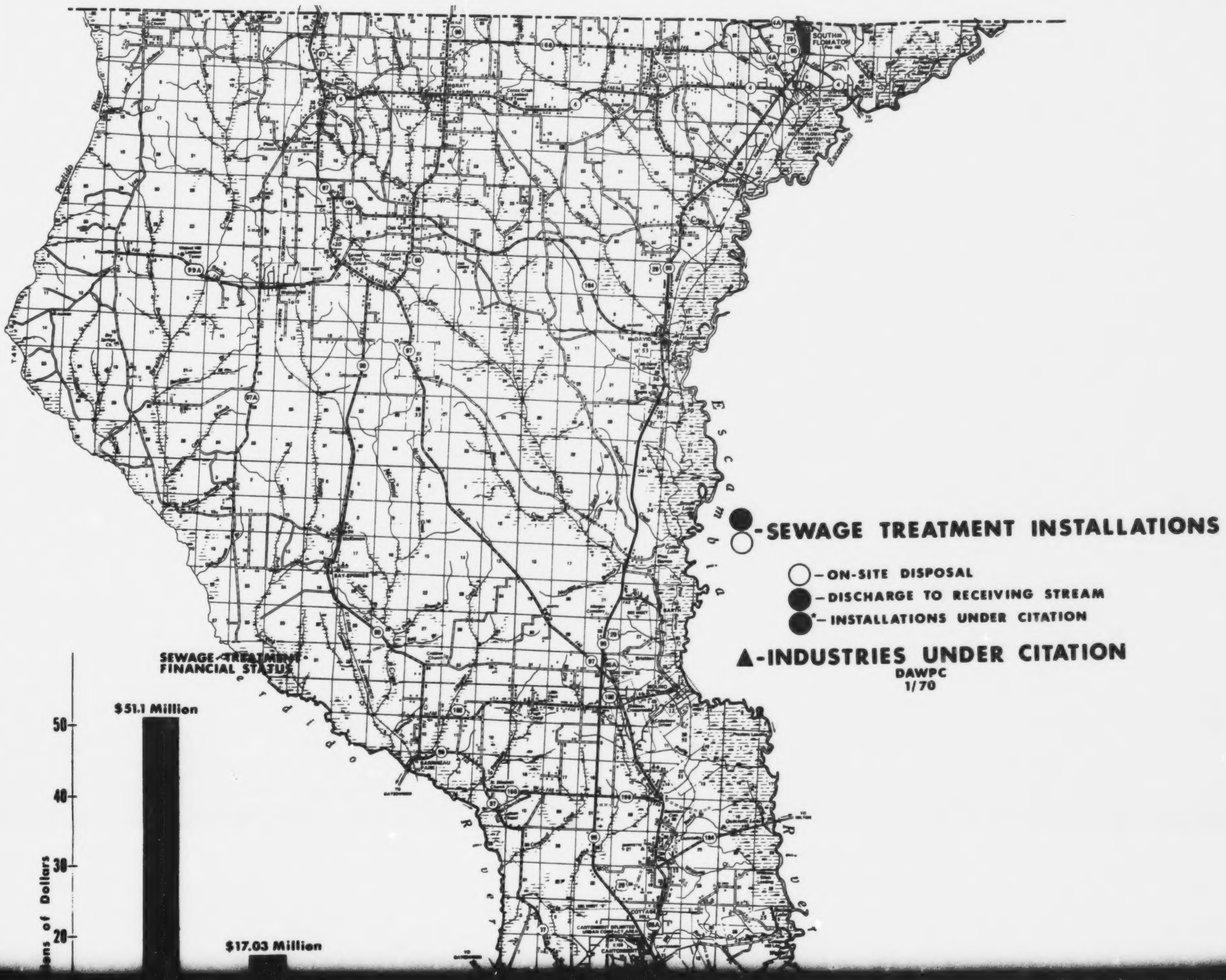
Escambia County

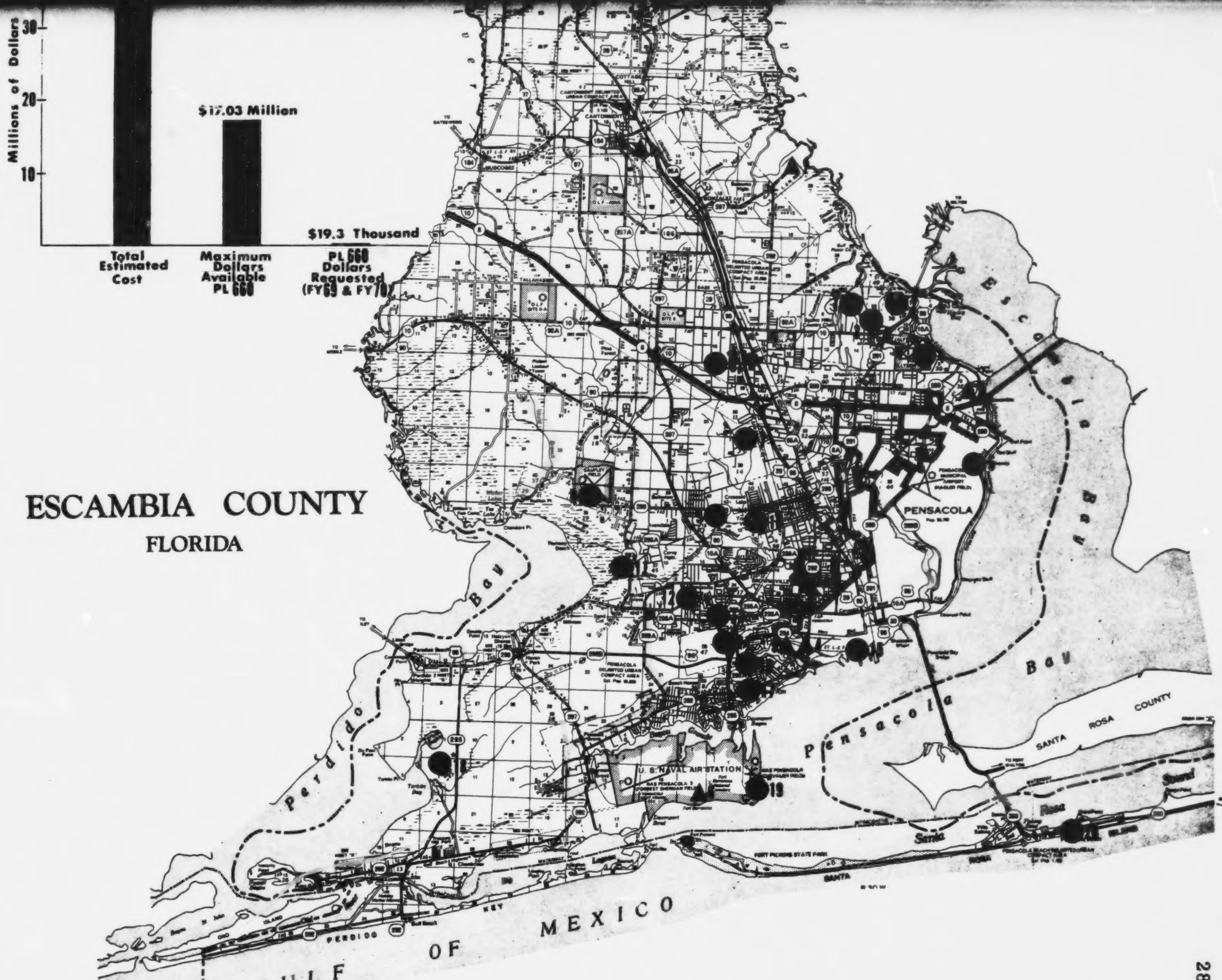
I. Sewage Treatment Installations

Number	Sewage System	Actual or Designed Average Daily Flow(ADF)inMGD	Population Served or Population Equivalent	Type of Treatment	Receiving Stream
13	Pen Haven S/D (Pensacola)	0.415	5,250	Trickling Filter	Ditch to Bayou Chico
14	Corry Field NAS (Pensacola)	0.210	2100	Trickling Filter	Jones Creek to Bayou Chico to Pensacola Bay
15	City of Pensacola (Devillers Street)	5.5	55,000	Activated Sludge	Pensacola Bay (Submerged Outfall)
16	Warrington Area (Pensacola)	0.055	550	Extended Aeration	Bayou Chico Creek
17	Moreno Courts (Pensacola Housing Authority)	0.210	2100	Activated Sludge	Jones Creek to Bayou Chico
18	Perdido Bay Country Club Estates (Pensacola)	0.035	350	Primary	Bayou Gordon to Perdido Bay
19	Pensacola NAS (Mainside)	1,700	17,000	Primary	Pensacola Bay (Submerged Outfall)
20	Santa Rosa Island Authority	0.500	5000	Trickling Filter	Santa Rosa Sound (Submerged Outfall)

II. Industries Under Citation

1	St. Regis Paper Company
2	MONSANTO Company
3	Westinghouse Corporation
4	Armstrong Cork Company
5	Ashland Chemical
6	U.S. Naval Air Station


SEWAGE TREATMENT INSTALLATIONS
○ – ON-SITE DISPOSAL
● – DISCHARGE TO RECEIVING STREAM
●* – INSTALLATIONS UNDER CITATION
▲ – INDUSTRIES UNDER CITATION
DAWPC
1/70
Escambia River
Perdido River
SOUTH FLOMATON
CENTURY
McDAVID
CANTONMENT
SEWAGE TREATMENT FINANCIAL STATUS
$51.1 Million
$17.03 Million
50
40
30
20
llions of Dollars



ESCAMBIA COUNTY
FLORIDA

Millions of Dollars
30
20
10
$17.03 Million
$19.3 Thousand
Total Estimated Cost
Maximum Dollars Available PL 660
PL 660 Dollars Requested (FY69 & FY70)
Escambia Bay
Pensacola Bay
Perdido Bay
PENSACOLA
U.S. NAVAL AIR STATION
SANTA ROSA COUNTY
Santa Rosa Sound
GULF OF MEXICO

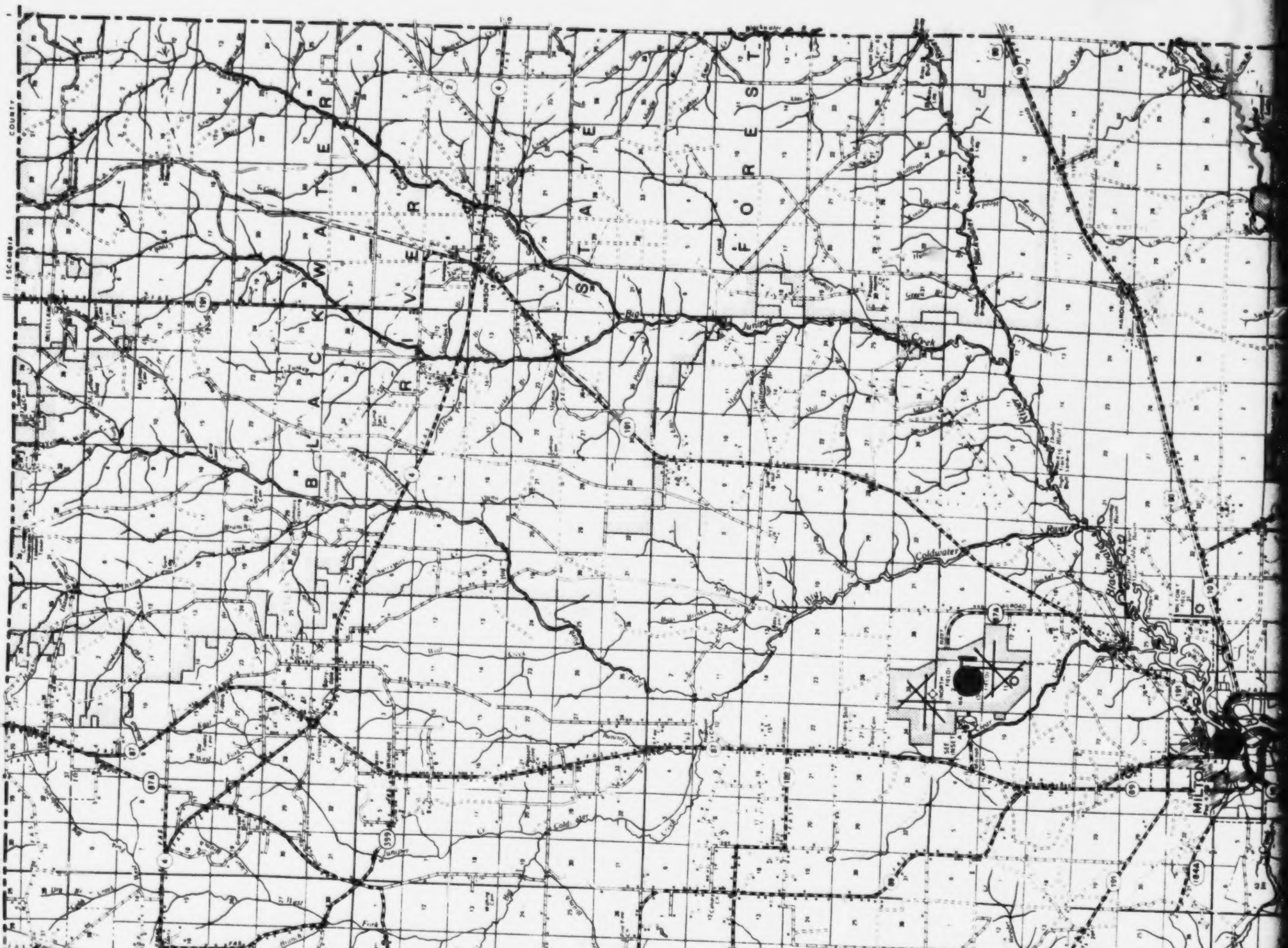
Santa Rosa County

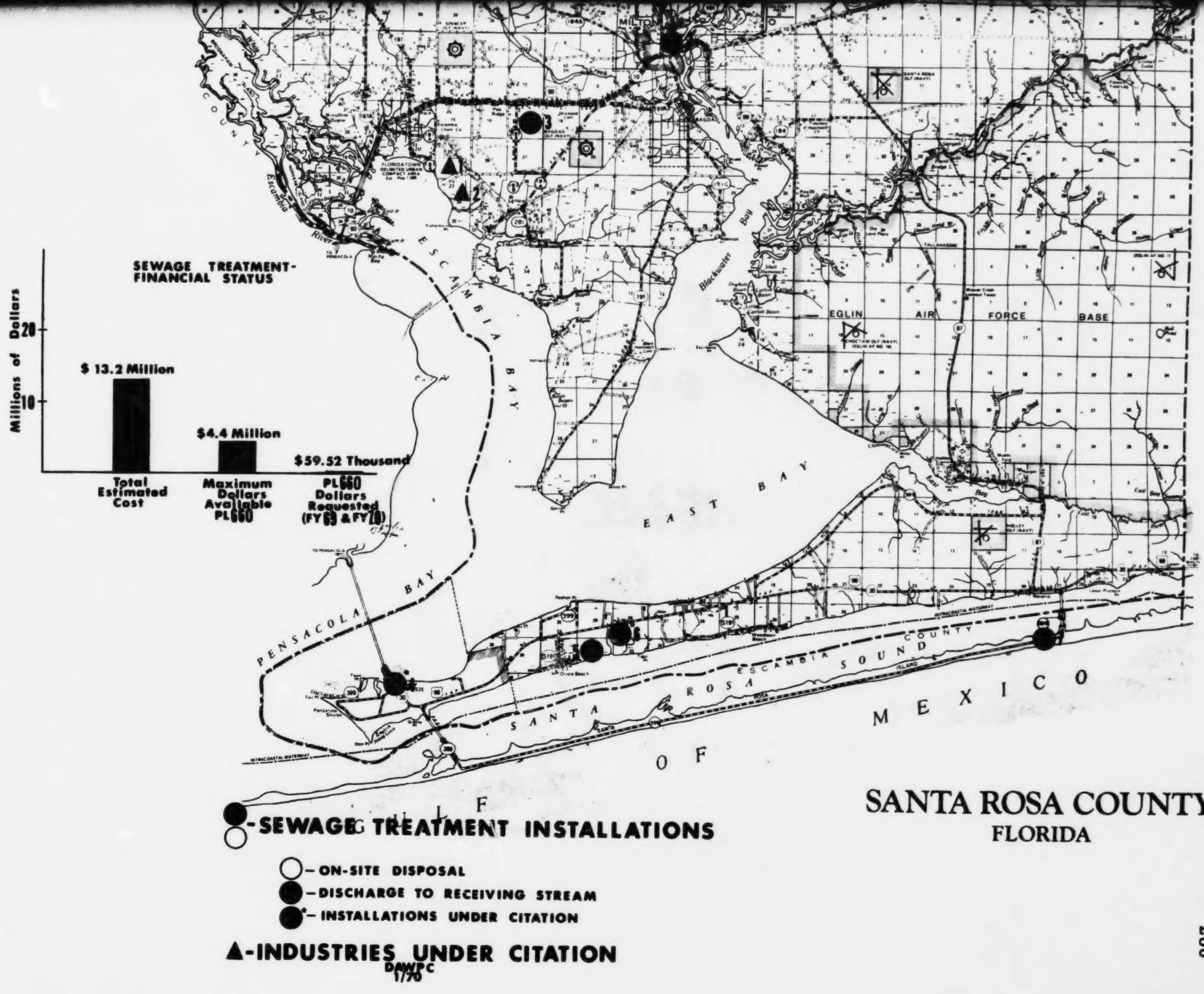
I. Sewage Treatment Installations

Number	Sewage System	Actual or Designed Average Daily Flow(ADF) in MGD	Population Served or Population Equivalent	Type of Treatment	Receiving Stream
1	Whiting Field NAS (Milton, Fla.)	0.700	7000	Trickling Filter	Clear Creek to Blackwater River
2	Town of Milton	1.2	6,900	Trickling Filter	Blackwater River
3	Santa Villa S/D (Milton)	0.014	140	(Open Lagooning) Primary	(Creek) Drainage Ditch
4	City of Gulf Breeze	0.014	200	Trickling Filter	Santa Rosa Sound
5	Venetian Isles S/D (Gulf Breeze)	0.032 (First Phase was	405 Septic Tank)	Trickling Filter	Santa Rosa Sound
6	Santa Rosa Shores S/D (Gulf Breeze)	0.015	110	Primary	Ditch to Santa Rosa Sound to Pensacola Bay
7	Navarre Beach	0.21	2100	Trickling Filter	Santa Rosa Sound (Not in operation)

II. Industries Under Citation

1	Escambia Chemical Company
2	American Cyanamid


BLACKWATER RIVER STATE FOREST
ESCAMBIA COUNTY
ESCAMBIA COUNTY
MILTON
Coldwater
River
Escambia
River
ESCAMBIA



SANTA ROSA COUNTY
FLORIDA

SEWAGE TREATMENT-FINANCIAL STATUS
Millions of Dollars
20
10
$ 13.2 Million
Total Estimated Cost
$4.4 Million
Maximum Dollars Available PL660
$59.52 Thousand
PL660 Dollars Requested (FY69 & FY70)
MILTON
BAGDAD
FLORIDATOWN
EGLIN AIR FORCE BASE
ESCAMBIA BAY
EAST BAY
PENSACOLA BAY
Blackwater Bay
East Bay
Escambia River
ESCAMBIA COUNTY
SANTA ROSA SOUND
SANTA ROSA ISLAND
GULF OF MEXICO
1
2
3
● - SEWAGE TREATMENT INSTALLATIONS
○ - ON-SITE DISPOSAL
● - DISCHARGE TO RECEIVING STREAM
●* - INSTALLATIONS UNDER CITATION
▲ - INDUSTRIES UNDER CITATION
DWPC
1/70

V. D. Patton

A hearing on a proposed statewide permit rule covering both air and water pollution sources was held before the Board of this Department on December 10, 1969. The testimony was considered at a meeting on January 15, 1970, and a permit rule was adopted. This will be filed with the Secretary of State shortly and will take effect soon. This will be filed for the record of this conference as soon as it is prepared in the proper form.

It should be pointed out that we have been concerned with the elimination of raw sewage discharges and upgrading the degree of biological treatment. The report presented has documented the facts concerning nutrients and actions that must be accomplished to provide clean water. We have stated wastes should be removed from our estuaries. This conference has emphasized this point.

MR. STEIN: Thank you, Mr. Patton.

Are there any comments or questions?

If not, thank you very much for your statement.

MR. PATTON: If I may, I would next like to call on Mr. de Castro, Chief of the Bureau of Enforcement, to give you a brief presentation on enforcement actions taken to date.

Mr. de Castro.

STATEMENT OF JOSE F. de CASTRO, CHIEF, BUREAU OF ENFORCEMENT, FLORIDA DEPARTMENT OF AIR AND WATER POLLUTION CONTROL,

TALLAHASSEE, FLORIDA

MR. de CASTRO: My name is J. F. de Castro. I am in charge of enforcement for the State of Florida.

First, we will give a brief summary of the statewide status of our enforcement program. Then, we will show what we have so far achieved and what we propose to accomplish by 1973. Finally, we will indicate the contribution of five major sources to the pollution of the waters of Escambia Bay and discuss their cases individually from our enforcement standpoint. At the end, we will attempt to answer any questions you may have on this subject.

The Department has under enforcement 147 cases. Sixty-two are liquid industrial waste and 67 of domestic and municipal nature. The remaining 18 encompass air pollution, agricultural and miscellaneous violations. Twenty-five percent of the current cases are involved with legal counsel.

All active cases have been updated and most wastewater projects are progressing satisfactorily towards compliance ahead of the January 1, 1973, deadline of Chapter 28-5 of the Florida Code. In addition, 40 cases have already been completed and/or closed out or placed in an inactive status.

Through persuasion, some facilities not under citations have now embarked on multimillion dollar pollution abatement projects with completion dates by mid-1971.

What have we achieved? What do we propose to accomplish? At the start of our program -- and I am going to refer you to that chart there -- the contribution of the cases now under consideration to the pollution of the waters of Florida was equivalent to that of a population of 10.5 million persons. Through continued enforcement and persuasion, we expect a reduction in pollution, equivalent to a population of 2 million, by 1971; 7.5 million by 1972; and a total reduction of 9.8 million by the target date of January 1, 1973.

So much for enforcement on a statewide basis.

The contribution of five major sources to the pollution of the waters of Escambia Bay this past summer was equivalent to that of a population of half a million persons. American Cyanamid was sharing 35 percent to this pollution; Escambia Chemical, 31 percent; Monsanto, 17 percent; Northeast Pensacola Sewage Treatment Plant, 13 percent; and Container Corporation, Alabama, 4 percent. These shares are based on total nitrogen equivalent. However, from a phosphorus and BOD standpoint, Container shares 13 percent and 33 percent, respectively, to the pollution of Escambia Bay. However, Mr. Traina mentioned that there is a process of stabilization on the way down as the Escambia River flows to the Bay.

The first two, American Cyanamid and Escambia Chemical, were cited on July 18, 1969, for failure to provide a minimum of 90 percent treatment to their liquid discharges to the waters of Escambia Bay. At that time, nitrogen releases were the primary concern. The Federal Water Pollution Control Administration has just released a report dated January 10, 1970, on the pollution of the waters of Escambia Bay. Their findings may result in the amendment of the original citations. An additional charge for releasing cyanates, in the case of American Cyanamid, was later dismissed on the basis that the thiocyanate ion detected in their effluent is neither a cyanide nor a cyanate as used in Chapter 28-5 of the F.A.C.

Escambia Chemical Corporation has submitted, and we have approved, an ambitious in-plant chemical

J. F. de Castro

recovery program based on sound water management techniques. By mid-1970, Escambia Chemical is committed with the DAWPC to have reduced their individual share in nitrogen and chemical oxygen demand to values better than the 90 percent minimum level called for in the Florida rules. Additional major in-plant changes already funded but yet to be submitted for our approval should reduce their contribution to the pollution of the waters of Escambia Bay to negligible values by mid-1972.

American Cyanamid has already submitted a preliminary engineering report on their plans. The characterization phase of their various waste streams for subsequent evaluation of possible recycles, in-plant changes and others is due for submittal to the DAWPC this coming April. As the result of their implementation of the required changes, water management and abatement techniques, we anticipate American Cyanamid's share to reduce substantially by 1971 and to negligible levels by January 1, 1973.

Monsanto Company was cited by the Board on November 21, 1969, for discharging nitrates and other constituents to the Escambia River and degrading the waters of Escambia Bay. This citation is too recent and still in the exploratory and conference stage. However, through appropriate water management and abatement processes, we expect Monsanto also to substantially reduce their share of pollution of Escambia Bay.

Here again, as the result of the FWPCA report dated January 10, 1970, the original citation may also have to be amended to include matters other than nitrates.

The Northeast Pensacola Sewage Treatment Plant has not as yet been cited. However, their case is still under review by the Department and we all should hear shortly further on this case.

As for Container Corporation of America, an out-of-state contributor, we await to hear from Alabama authorities of their abatement plans; not only on nitrogen but also on carbonaceous matter, lignin, and color contribution to the waters of Escambia Bay.

To close this presentation, we wish once more that without neglecting lesser cases -- which incidentally are also progressing satisfactorily -- we have so far placed stress on major cases of pollution both statewide and locally. We wish to acknowledge the cooperation and collaboration given so far by industry and municipalities. They should be credited in part for the accomplishments that the Department of Air and Water Pollution Control of Florida has so far obtained.

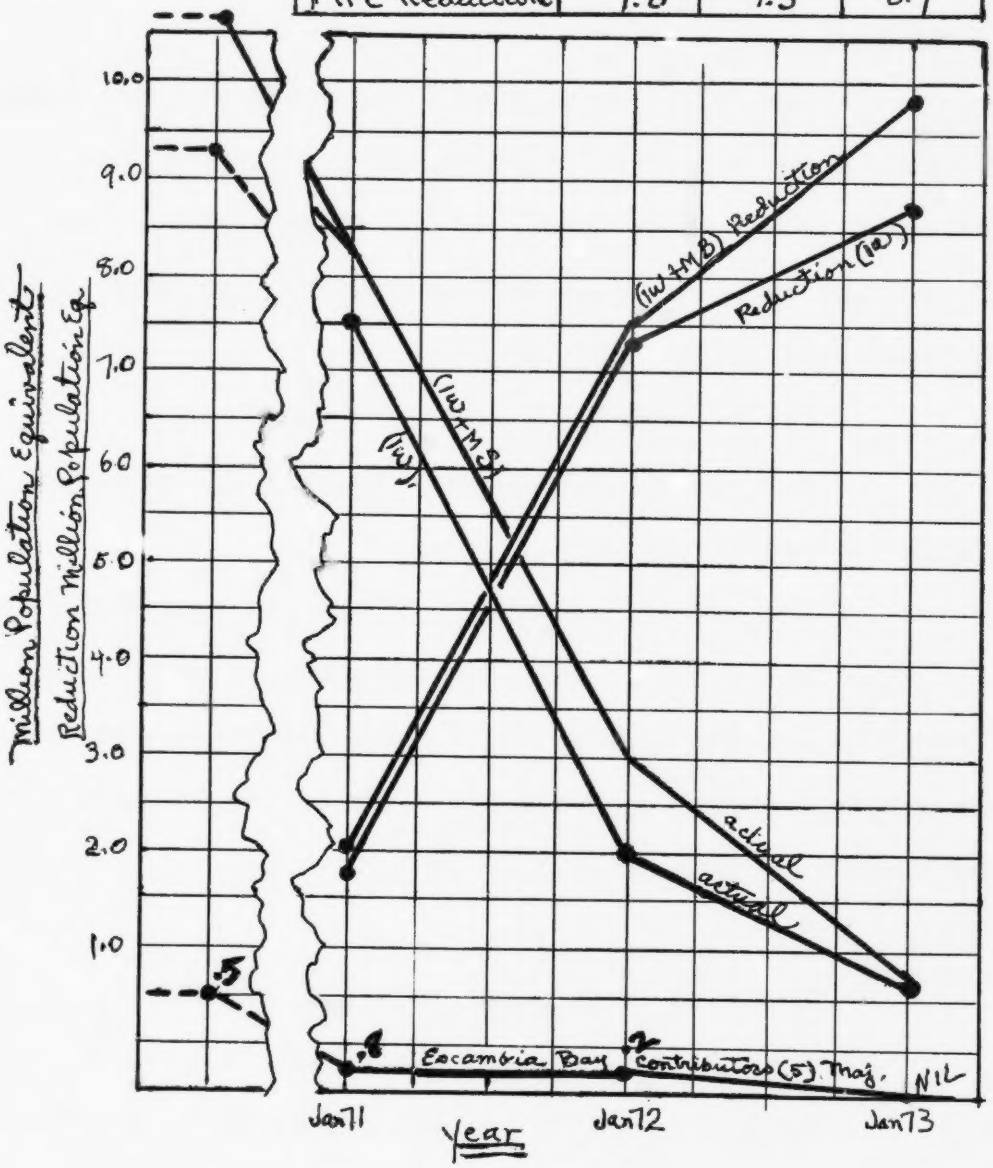
(The chart referred to by Mr. de Castro follows.)

Pensacola
Jan. 20-22, 1970

SUMMARY

	MGD	C/T MPE	Jan 71 MPE	Jan 72 MPE	Jan 73 MPE
Paper Mills	262	7.0	7.0	1.5	.5
Sugar Mills	172	.9	0	0	0
Escambia	100	.5	.2	.2	nil
Other Mills	48	.9	.3	.3	.1
	582	9.3	7.5	2.0	.6

	Jan 71	Jan 72	Jan 73
MPE Reduction	1.8	7.3	8.7



MR. STEIN: Thank you, Mr. de Castro.

Are there any comments or questions?

Not all your citations are in accord with the recommendations made this morning, are they?

MR. de CASTRO: They may not be. We emphasize on nitrogen.

MR. STEIN: Now, again, without prejudging this, you have ample authority under the Florida law, if the conferees should adopt these, or a variant of these, to adjust your citations to have them conform with this program to clean up Escambia Bay?

MR. de CASTRO: I would say yes.

Perhaps Mr. Patton could answer that question. I will say yes, definitely.

MR. STEIN: All right. Thank you very much.

MR. PATTON: Next, Mr. Chairman, I would like to call on Mr. Huffstutler for a brief report on planning activities. He is the project manager of the Escambia and Santa Rosa Task Force.

STATEMENT OF K. K. HUFFSTUTLER, PROJECT MANAGER, ESCAMBIA AND SANTA ROSA TASK FORCE, FLORIDA DEPARTMENT OF AIR AND WATER POLLUTION CONTROL, TALLAHASSEE, FLORIDA

K. K. Huffstutler

MR. HUFFSTUTLER: Mr. Chairman, Dr. Myers, Chairman Reed, ladies and gentlemen.

The present development of northwest Florida clearly presents the needs for future planning if area waters are to be protected. In the early 1950s no consideration was given to the possibility of eutrophication of our waters, therefore no provisions were made to cope with the effects. Plans for treatment of domestic and industrial waste were approved on the basis of the latest known technology and with such, it was assumed that the receiving waters could assimilate the discharges. The only fear was the accumulation of an excessive number of effluents thereby offsetting the acceptable degree of treatment.

Experience has taught that this philosophy is outdated. Today we must continually be on the alert for new effects of supposedly harmless components and look for new methods and means of treatment and disposal of waste. More and more, the thinking is turning toward no waste discharge at all brought about by complete containment, treatment adequate for reuse and reducing requirements for raw water. Other trains of thought are toward combining numerous effluents and discharging them into large bodies of waters to gain the benefits of assimilation, but care must be exercised not to overtax the receiving waters.

An unacceptable problem has developed here on Escambia Bay and Escambia River. Toward the solution of this problem and its prohibition in this and other areas, the Florida Department of Air and Water Pollution Control is attempting to develop a comprehensive plan. Some of the accomplishments hoped to be attained are:

1) The separation of effects or changes in physical, chemical, biological and bacteriological characteristics of the Escambia Bay and Escambia River due to natural causes and those resulting from man's activities.

2) Study the effects of components, as individuals and in various combinations, heretofore assumed to be unimportant.

3) Determine possible effects of all components on new receiving waters.

4) Explore possibilities of new treatment techniques and disposal methods.

5) Develop the advantages of prelocating new industrial, military and population expansions. In essence, zoning and land use.

6) Documentation of existing conditions in presently unpolluted waters of the area in order to maintain them.

7) Conduct a continuing educational program to retain the high interest and activity in pollution control.

8) Involve all special interest and governmental agencies in a cooperative program of future growth and development of the area.

To initiate the desired project briefly outlined above, the Department of Air and Water Pollution Control has completed a "Grant Application" to the Federal Water Pollution Control Administration for aid in developing a "comprehensive water pollution control plan," as provided under Section 3(c), P.L. 84-660, as amended. At this time, it is slightly embarrassing to admit that the Department has no money to be matched by FWPCA, however all possibilities have not been exhausted and hope still exists. Should the money necessary to fulfill our desires fail to emerge, the Department will accomplish the same ends through cooperative efforts of all parties and people involved. We may move at a snail's pace, but the problem will be solved because it is imperative that it be done.

Positive statements such as this are easily made because of the quality and quantity of people that have dedicated themselves to the task. For example, the Governor of Florida has appointed a West Florida Natural

K. K. Huffstutler

Resources Council, chaired by the President of the University of West Florida, which is charged with the responsibility of developing and maintaining the natural resources in its part of Florida. The Council encompasses the Department of Air and Water Pollution Control, the Board of Regents of all Florida's universities, local members of the State legislature, U. S. Department of the Interior, local citizens, development councils, military, Florida Department of Natural Resources, Division of Game and Fresh Water Fish, and Department of Agriculture.

In addition, and within the organizational structure of the Council, there have been appointed two task forces that have recently been joined. The responsibilities of this joint force are to improve the conditions of the waters of Escambia and Santa Rosa Counties plus the establishment of the conditions of Choctawhatchee Bay and protect its quality. The memberships of the task force are comprised of the Department of Air and Water Pollution Control, Division of Health, University of West Florida, FWPCA, State of Alabama, and members o the State legislature, local governments, and local citizens.

With attention to the problems being given by this type of representatives, we cannot fail. Thank you.

MR. STEIN: Thank you.

Are there any comments or questions? Thank you very much.

MR. HUFFSTUTLER: Thank you, Mr. Chairman.

MR. PATTON: Next, Mr. Chairman, I would like to call on Mr. Joe Blanchard to give a presentation for the Game and Fish Commission.

Mr. Blanchard.

STATEMENT OF JOE BLANCHARD, REGIONAL FISHERIES BIOLOGIST, FLORIDA GAME AND FRESH WATER FISH COMMISSION, DeFUNIAK SPRINGS, FLORIDA

MR. BLANCHARD: I am Joe Blanchard, representing the Game and Fresh Water Fish Commission, and I give this report in the name of our Director, Dr. O. E. Frye.

On May 21, 1969, the Florida Game and Fresh Water Fish Commission presented a report to the Florida Air and Water Pollution Control Commission that covered the available fish population data on the Escambia River from 1957 to the present. A copy of this report is available in the transactions of the May 21 hearing.

The Game and Fresh Water Fish Commission

J. Blanchard

offered the following recommendations:

1) A project restoration team be assigned to the Conecuh-Escambia Basin at this hearing to locate and document sources of pollution, monitor waters of the Conecuh-Escambia River Basin both chemically and biologically and report monthly to the regulatory agency with recommendations to restore the river to a productive fishery. The scope of this project should include provisions to reassure the local people that a total effort will be put forth to restore the river.

2) The Escambia River be placed under a special classification with 5 mg/l dissolved oxygen being set as the minimum criteria and/or a saturation level of 70 percent.

3) The water quality of the State of Florida be expanded to include a nutrient standard based on the assimilated capacity of the river.

4) Initiate a research project to document the effects of color on aquatic ecosystems for the purpose of establishing a color criteria for the Escambia River and other fresh waters of the State of Florida.

The May 21 hearing resulted in the establishment of a Task Force of which our Director, D. O. E. Frye, is a member. Research reported to the Task Force has resulted in several new citations.

Our only new recommendation at this hearing is to suggest that wherever possible treatment be effected before the January 1, 1973, deadline.

The Game and Fresh Water Fish Commission pledges complete cooperation with the Florida Air and Water Pollution Control Department and the Federal Water Pollution Control Administration and will offer assistance whenever possible.

MR. STEIN: Thank you.

Are there any comments or questions? Why don't you stay there for one second. I have a comment on this as well as the previous one.

First, I would like if you would do this for me: Give my regards and compliments to Dr. Frye, whom I have known for years.

MR. BLANCHARD: I will, sir. He had a cabinet meeting today and I know he is sorry he couldn't be here.

MR. STEIN: Right.

But the second point, dealing with all of the studies, and I know they are needed, is: I think by our very presence here, and the fact that we were called here by Governor Claude Kirk of Florida indicates that we are here for an action program.

J. Blanchard

Now, I think all of the study programs are fine and certainly I will do everything I can to support them, but I also would like to give this for your consideration: that I don't think any study programs should in any way hold up the action program for a completion of some study, if we can agree on an action program to clean up the Escambia system.

Secondly, it may be wise, if we can agree on an action program as a result of this conference, to adjust the study programs wherever they are to fit in with this and complement this, because I think we are all working on the same thing. But I would hope we would all agree that the priority is a cleanup and we don't want to hold anything up for study where we can make a decision on the cleanup and proceed to the cleanup now.

MR. BLANCHARD: I believe we are in complete agreement on that.

MR. STEIN: Thank you.

MR. PATTON: Next, I would like to call on Mr. Bjarne B. Andersen, Assistant Attorney General.

STATEMENT OF BJARNE B. ANDERSEN, JR.
ASSISTANT ATTORNEY GENERAL, STATE OF FLORIDA, TALLAHASSEE, FLORIDA

MR. ANDERSEN: If the conference please, for the record, at this time, representing the Attorney General, Earl Faircloth, and as the legal advisor of the Department, we refrain from making any official statement into the record.

Thank you.

MR. PATTON: Thank you, Mr. Andersen.

MR. STEIN: The next time you engineers tell us that us lawyers are windy, I am going to point out Mr. Andersen.

MR. PATTON: Next, I would like to call on Mr. J. A. Edmisten, Associate Professor and Advisor to Congress, University of West Florida.

I don't believe the doctor is here right now. Let's pass on.

Are there any other representatives of State agencies who wish to make a presentation or statement?

I don't believe so.

Mr. Chairman, I would like to recognize Mr.

Phil Doherty, our Regional Engineer for this part of the State, if he is here. Phil, if you would please stand up.

Mr. Berkowitz, Chief of the Bureau of Sanitary Engineering, Division of Health, Department of Health and Rehabilitative Services.

And Officer Zangas of the Department of Natural Resources. I believe he is missing right now.

We have already heard from Mr. Law, and I believe the next person we have that has asked to be heard is Mr. Walter Cline, Plant Manager of Monsanto Chemical Company.

Mr. Cline.

STATEMENT OF WALTER T. CLINE, PLANT MANAGER, MONSANTO COMPANY, PENSACOLA, FLORIDA

MR. CLINE: Mr. Chairman, and ladies and gentlemen, I am Walt Cline, Manager of Monsanto Company's nylon plant at Pensacola, Florida. We appreciate the opportunity to appear before you and make a statement of our position relative to the information and recommendations presented at this conference.

W. T. Cline

We recognize that water quality is one of the major environmental problems faced by the Escambia Bay area today. Our plant, along with all other sources of waste, has a vital stake in the search for improved environmental quality.

The efforts of Monsanto-Pensacola to protect the water quality in this area began even before we started construction on this nylon plant in 1951. These efforts have included research to determine the possible effects of plant wastes, and the collection of technical information and background data on the Escambia River. Throughout the years, these data have been made available on a cooperative basis to appropriate Federal, State and local agencies for the benefit of everyone in our area.

During the 17-year history of plant operations, Monsanto has invested in excess of $8 million in pollution abatement. The first part of this sizable investment was spent on construction of retention ponds which segregated process wastes. These ponds enabled the plant to comply with all existing water quality regulations, and the State of Florida granted us a permit to remove organic materials from these wastes.

Since 1957, we have invested $3 million to remove organic materials from the plant wastes. The first $2 million was spent on secondary biological treatment to achieve an 80 percent reduction. Operation of these treatment facilities cost one-half million dollars per year. Because of extreme difficulties encountered in treating our process wastes, an additional $1 million investment was required for process treatment modifications to achieve a 90 percent treatment level.

Today, we remove 97 percent of the BOD (biochemical oxygen demand) load generated at our plant. This 97 percent reduction represents a removal of 260,000 pounds a day from our effluent before it is discharged to the river.

The Escambia River and Upper Escambia Bay area is classified as "Class III Water" by the Florida Department of Air and Water Pollution Control. The Monsanto-Pensacola plant has through the years, and presently, meets all standards established by the State of Florida for Class III waters.

Over and above these requirements, we have worked since last July on a cooperative basis with the Florida Department of Air and Water Pollution Control on the question of nitrate and phosphate levels in Escambia Bay. We are pleased to announce today that process changes have been implemented during the past two months which are substantially reducing our nitrate and phosphate discharges to the river.

I assure you that the Monsanto-Pensacola plant is fully aware of its responsibilities as a corporate citizen in this community. We have fulfilled these responsibilities in the past and have willingly complied with all state pollution regulations and we intend to continue to do so in the future. We appreciate the opportunity to present our comments to you, as we have appreciated working with the Florida Department of Air and Water Pollution Control in its efforts to safeguard the water quality of our state.

Mr. Chairman, as you are aware, Monsanto received the Federal report for this conference on January 15, 1970. Should further study indicate a need, we respectfully request the opportunity to submit additional written comments for the record within the next 15 days.

I thank you very much for this opportunity to appear before you.

MR. STEIN: Are there any comments or questions?

MR. THOMAN: I have got a couple of questions. Do you want to comment on his request?

MR. STEIN: I will wait until I hear your comment.

MR. THOMAN: Mr. Cline, I don't know whether I should address this to you. I notice that another member of your staff, the Superintendent of Manufacturing and Technology, I believe, is due to present a statement.

This 97 percent reduction that you are talking about, is that done in a treatment plant, or is that done by discharge to these deep wells that were mentioned?

MR. CLINE: It is done by discharge to retention ponds and to the deep wells.

MR. THOMAN: From my own standpoint and edification, what has been done to monitor what effect these wastes may have on discharge into the aquifer that they are going into?

MR. CLINE: We have worked with the U. S. Geological Survey; we have worked with the State of Florida. We have agreed to put monitor wells down for them to check, and we have presented data on a regular basis on these wells.

MR. THOMAN: In other words, there are monitoring wells.

MR. CLINE: Yes.

MR. THOMAN: Mr. Stein, would it be appropriate to ask that some of this information be submitted for the record?

MR. STEIN: Yes.

MR. THOMAN: That is all I had to ask.

MR. CLINE: Thank you.

MR. STEIN: Mr. Cline, there may be a later speaker doing it, but I think the key points that I think either you or someone else from your company might want to address themselves to is the notion of the recommendations made in this report. There are certain limits for allowable waste discharges recommended in the report that the Federal field report recommends for Monsanto for carbonaceous, nitrogenous, and phosphorous materials, and also for reduction of heat, which I didn't hear in your remarks.

Do you have any comment to make on those three as to the appropriateness of the Federal recommendation?

MR. CLINE: Well, let me address myself first to the problem of heat. We did note this recommendation in the Federal report. We will certainly take this under advisement, but we have not had time to study this problem and we are not in a position to comment on that at this time. So far as the other parts of the report, again, we have had this for a very short period of time, but we are reviewing it, and we will continue to review it, and certainly we are as interested in improving the condition in Escambia Bay as anyone else. We have 6,000 employees that use the waters in these areas, and we will certainly work with the State departments in doing everything that we can to be the good corporate citizen that we have been, but I have no further comments other than that at this time.

MR. STEIN: The point is, in the 15 days, if we hold the record open, can we expect your comments on these four points?

MR. CLINE: Yes.*

MR. STEIN: On what you think about these four points?

MR. CLINE: Yes, you certainly can.

MR. STEIN: Again, I note something here that we have not had before. Now, let's just lay it on the table.

We came in this case because we were asked to come in by Governor Kirk. We are obliged to make a record and we are obliged to ask for the report. But sedulously in your statement -- and by the way I don't want to single this out because industries have done this throughout the history of our program -- you indicate that you are very interested in complying with the State and the State requirement.

Again, you have got another factor now. You

* See Page 549.

have got the Federal Government, maybe whether you like it or not or we like it or not. But the point is: we are here. And the point is: the sooner we both recognize it, the easier it will be to proceed wherever we go in the future, because we are going to ask for this report, and this is the record that the Federal Government is in.

Now, as far as I can see, sir, in a case of this kind, and in cases in the future, I don't look for any division or dichotomy between us and Florida; we are operating as one staff and practically as one agency in this.

MR. CLINE: Well, let me say this: Number one, I will address myself to the first part. We did not or I did not fail to comment about your position in this intentionally. It was my understanding that you were making this study at the request of the Governor, and that these recommendations would go to the State, and then that the State would come back to us with additional citations or whatever information was necessary.

Now, if I am in error in this, this was the understanding that I have had from the very beginning, but there was certainly no intentions of --

MR. STEIN: Right. I don't think you are. I think in the future, as far as I can understand it, and if I can have anything to do with it, and as far as I can read the State agency, and they can see for themselves, I doubt whether any industry or community in this area is going to get a recommendation that the State and we aren't in complete agreement with, and are moving forward with together from now on.

MR. CLINE: Then, we won't have any problem, will we?

MR. STEIN: I hope not, but you have to recognize that we were asked in here, and under the statute, whether we like it or not, but I don't do this reluctantly; we just have a Federal responsibility that we have to exercise.

MR. CLINE: We understand this, and we appreciate this, and we certainly -- again, let me reemphasize that we want to cooperate with any and all authorities in order to clean up the situation which exists.

MR. STEIN: All right.

Now, let me make this very clear. What I would like -- you know you don't have to do this if you don't want to because -- this is right -- this is not a hearing, this is not under oath --

MR. CLINE: I understand.

MR. STEIN: I really mean this. But the things we are looking for -- there is a chart on page 6 with two figures on carbonaceous material, three figures on nitrogenous material, and two more figures on phosphorus, and we would like your views on those together with the time schedule that is recommended by the report, and your views on the reduction in heat recommended by the report plus your comment on the time schedule there.

Again, these are the things we really are looking for, and we would certainly be happy to keep the record open for two weeks to either get your response to that or non response.

MR. CLINE: Thank you so much.

MR. STEIN: Thank you very much, sir.

MR. THOMAN: I am sorry to be beating this over the head, but our Assistant Secretary has recently taken a very strong stand, and it has fit in with our regional policy of discouraging the use of deep wells for the disposal of wastes.

I am disturbed on many, many, many occasions by the fact that the States have permitted the disposal of highly concentrated wastes to various subterranean aquifers. I don't know whether this is bad, and I don't know whether it is right. At the present time, the Federal Water Pollution Control Administration is attempting to develop, in connection with other elements of the Department of the Interior, some sort of a National policy on this. I understand, from talking with my office at noon, that a draft of this is there for review by next Monday.

I think that it would be of tremendous assistance to us if the Monsanto Company could furnish to us the technical information on your deep well disposals, the monitoring wells, and the results of this, and what effects, if any, it has on the aquifer.

Any technical information of this nature that you could furnish to us would be of much value in eventually arriving at some sort of an equitable Federal policy regarding this.

The Secretary has commissioned the U. S. Geological Survey to proceed posthaste with a study of this, and I don't know where they stand at the moment, but some position has got to be taken on this, and anything you can give us would be helpful.

MR. CLINE: We would certainly be happy to cooperate in any way possible in this regard.

MR. STEIN: As long as he brought that up, let me just zero in on this.

I think you have two problems here: one is the general problem of deep well disposal; but the other issue, as I read the report, is putting organic material in deep wells. Now, maybe you can't lump them altogether, but where you can't treat an inorganic, when you put it in the stream it is going to stay in that stream until it gets out to the sea, you may have one situation. However, at least theoretically organics can be brokwn down, and we all know from the basis of experience that when you put an organic in an underground formation, you may have it placed for millennia.

I know if you go to the area around Lafayette, Indiana, and you drink the water that they get from the well, you can get a hydrogen sulfide taste in that water, and the material that went down there went down geologic ages ago, and it still is as characteristic as any smells that you would get when you have algae dying, or when you have a fish tank that is bad; and this has lasted for over millions of years.

Now, I think, if you address yourselves to this, I think the key thing to do is to indicate, one, why an organic should be put down in there in the first place; and, secondly, the strata this is going into — whether this is a usable strata or can be a usable strata; and, thirdly, what assurance there is that it isn't floating around in that strata and moving to parts unknown or parts where it may come up and be used.

I think these, again, are the questions that are going to be asked on the deep well.

MR. CLINE: All right. Thank you. We have much data in this area, and we have been very --

MR. STEIN: Let me assure you I have no judgment on this.

MR. CLINE: We have been very open and very straightforward in providing reports and having the monitor wells put down at our expense, as a matter of fact.

MR. STEIN: I know.

MR. CLINE: But we do appreciate your comments and I think I understand.

MR. STEIN: Thank you.

MR. PATTON: Mr. Chairman, the next person I have on the list is Mr. J. Lippe, Superintendent of Manufacturing Technology at Monsanto.

Mr. Lippe apparently does not want to be heard.

The next person we have is Mr. T. L. Carey of Escambia Chemical Company.

Mr. Carey.

STATEMENT OF T. L. CAREY, PRESIDENT, ESCAMBIA CHEMICAL COMPANY, PENSACOLA, FLORIDA

MR. CAREY: Mr. Chairman, conferees, ladies and gentlemen, my name is T. L. Carey, and I am President of Escambia Chemical Corporation.

We received a copy of the report, "Effects of Pollution on Water Quality Escambia River and Bay, Florida," on Thursday afternoon, January 15, although Mr. Patton did supply us with some excerpts from the report earlier.

Insofar as we have been able to study and evaluate the report, it appears to be an excellent study and one that will prove valuable in helping to solve our pollution problems.

I am pleased that the report notes Escambia contributes only one percent of both the 5-day BOD and TOC discharged to the study area. I would like to point out that this result represents a lot of hard work and expenditure of large sums of money by Escambia. Our calculations indicate from 93 to 96 percent treatment prior to discharge to the bay. The report also notes under the heading "Toxic Wastes" that "No compound in the Escambia effluent had concentrations greater than 5 mg/l."

It now appears that we do have a nitrate and phosphate problem. This seems to be a case of too much of a good thing because these are nutrients and are essential to both plant and animal life. We have control and recycle systems for these products and have additional planned projects that will result in further nitrate and phosphate effluent reductions. It should be noted, however, that Escambia is a primary producer of ammonia and nitrate products and measures its production of these products in the hundreds of thousands of annual tons.

There are two further specific points I would like to make about Escambia's effluent: 1) The average pH is 7.2 -- that is essentially neutral; 2) It contains no settleable solids.

Now, I would like to comment briefly on Escambia's history and interest in pollution control.

Escambia has always had a sincere interest in both air and water pollution control. In 1955, a biological consulting firm was engaged to make a study of Escambia Bay and make recommendations to aid us in our operations. The comprehensive report of their findings was submitted to us on October 5, 1955.

T. L. Carey

We have monitored our effluent on a daily basis and have reported these results to the Florida State Board of Health since 1959.

The consulting firm of Black, Crow and Eidsness has been on continuous retainer to Escambia since 1964 to advise and counsel on matters of pollution control.

We presently have Dr. James B. Lackey, formerly Professor of Sanitary Science at the University of Florida at Gainesville, on retainer. He is making a number of detailed studies of the bay and of our treatment facilities to aid us in our pollution program.

Over the years, Escambia has spent large sums of moneys on pollution equipment and controls at the Pace plant location. This equipment consists of scrubbers, distillation columns, cooling towers, recirculating systems, holding and treatment ponds and the operating controls for such devices. As a matter of interest, Escambia purchased and installed the first catalytic combuster on a nitric acid plant in this country. This device converts nitrous oxides to harmless nitrogen and is still in use doing an outstanding job.

Concerning the citation by the Florida Air and Water Pollution Control Board, Escambia Chemical Corporation was cited recently by the Florida Air and Water

Pollution Control Board for pollution of Escambia Bay. Corrective action ordered by the board included filing of an engineering report on "proposed treatment for its industrial waste discharge to attain required compliance to Chapter 28-5, F.A.C." It was specified that the report be submitted within 45 days of receipt of the citation.

The required report of the proposed program was submitted and after further discussions and submissions, the Department of Air and Water Pollution Control did accept Escambia Chemical's proposals to continue its in-plant wastewater pollution abatement program as set forth in a letter dated November 20, 1969. The department requested monthly progress letters showing weekly results on specific analysis for various plant streams and similar results on samples at the outfall weir. These reports are being submitted.

In addition, the department requested a "retained engineer submittal no later than June 1, 1970, of a formal 'Engineering Report,' on the achievements attained; also, contemplated achievements and timetable on the balance of your overall pollution abatement program for compliance with Chapter 28-5 F.A.C." This, too, will be done.

I submit that Escambia is in compliance with all orders and requests from the Florida Department of Air and Water Pollution Control.

Now, if I may, I would like to make a number of suggestions with regard to the report and the recommendations contained therein:

1) Since there has been such little time to study the report, it is suggested that the time available to submit a further statement be extended at least 30 days. Walt Cline didn't help me any with his 15 days!

2) When making specific recommendations for allowable discharges from each source, an "equitable" allowance for each source should be determined based on the degree of treatment presently in place. Further, "magnitude of the problem" and "technical feasibility" should also be taken into account when recommending allowables.

3) The alternative recommendation for a sewer collection system around the entire bay with a control treatment facility with final discharge away from the bay appears worthy of study. It is suggested that this should be pursued and Escambia would be pleased to participate in such a study.

In summary, we think the report is an excellent piece of work for having been accomplished in such a short period of time and will make a real contribution toward helping to solve the pollution problems. And, finally, Escambia is genuinely interested in solving the pollution problems and stands ready to carry its full share, as evidenced by the significant contributions already made toward pollution abatement.

Thank you for the time to make these statements.

MR. STEIN: Thank you, Mr. Carey.

Why don't we follow the statesman-like approach of Mr. Cline and give you 15 days, too, to put in the additional material?

MR. CAREY: I would be pleased to modify the request on that point.*

MR. STEIN: There may be some other comments or questions.

Again, I think it would be very helpful if you would address yourselves to the specific numbers in the chart on page 6 of the report as they relate to Escambia Chemical Company and have your comments on these. I think the notion of a joint system has as a prerequisite at least an agreement on the total loading that can go into the bay, into the system, and an agreement that the allocation of each of the significant sources is equitable, because you are going to put it in this combined system anyway. So I think the first step is to try to see if we can get some kind of judgment on what you think about that.

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* See Page 605

MR. CAREY: Basically, I think, if it is determined that that is the proper total allowable to the estuary, then my point is that these should not be assigned primarily on the basis of what it is today, without taking into consideration those who have contributed already. Now, we may be good in one area and bad in the other, and I will take it, goose and gander, kind of situation, but what has been done within the company proper and the efforts they have made on each one of these things should be taken into account when establishing the allowable, even though the total still adds up to whatever is determined.

MR. STEIN: By the way, I would certainly agree with you. As a matter of fact, I think I alluded to that with the Container Corporation in Alabama, who we have dealt with in the past case and I think deserve consideration for their removal of about 80 percent of the BOD that they are doing now.

We have to recognize that what this report is asking them is to do something in addition. What they have done is in accordance with the requirements we have laid down in the past.

But you did say one thing there, Mr. Carey -- and, again, maybe we can both agree on this: You indicated that the carbonaceous, the nitrogenous, and the phosphorous materials are needed by plants and animals. I sure agree with you, that is what is creating the problem in the bay. But according to our report, you put out fertilizer, alcohol, ammonia, and polyvinyl chloride. I wish you would keep all these out and sell them to the people who can use them without putting them out in the bay.

MR. CAREY: Amen. I hear that from others, too. But let me just repeat: There is a thing called technical feasibility, and there is another item called magnitude of the problem.

For example, we produce substantially in excess of 100,000 tons of ammonia per year. Now, our problem obviously as far as ammonia is concerned is somewhat different than someone who uses maybe 50 tons a year.

All I request is an equitable treatment, and we will take our --

MR. STEIN: You can be sure that we will work with that.

Now, let me again state another principle to see if we agree with that, because I think what you say is entirely correct, but again you need a prerequisite to do it.

Presumably, and without making a judgment one way or the other, there are certain limits of these materials that the bay can stand if it is not going to be in a polluted situation. I think the first step is that we have to come to a real agreement on how much in total we can put into this waterway in order to protect it. Once we get to an agreement on that -- I think this is a real hard agreement that we have to work out -- then the question of the allocation becomes a matter of equity that we go on.

But, if we don't have that first thing, we don't know what we are dividing up. We have to get all the major parties -- and as I view these major parties listed here: American Cyanamid, Container Corporation, Escambia, Monsanto, and the Northeast Pensacola Treatment Plant -- all these parties and Alabama, Florida, and the Federal Government, have to come to an agreement of what will go into the bay. Then, once we have the amounts, then we can work back from those amounts to work out an equitable distribution. But you can't start a discussion unless we know what we are dealing with and what we are dividing up.

MR. CAREY: Well, I have no quarrel. Once we establish the total allowable into the estuary, then the

the matter of how it is broken up, I only request that it be done equitably.

MR. STEIN: Yes. And I couldn't agree with you more on that approach.

Thank you very much, sir.

Mr. Patton.

MR. PATTON: If I may, Mr. Chairman, I will put this mike over at the end of the table for the next speaker. The next person that has asked to be heard is Mr. Gilbert J. Kenngott, Manager of the Santa Rosa Plant of the American Cyanamid Company, Pensacola.

STATEMENT OF GILBERT J. KENNGOTT, MANAGER, AMERICAN CYANAMID COMPANY SANTA ROSA PLANT, PENSACOLA, FLORIDA

MR. KENNGOTT: Mr. Chairman and conferees, I am Gilbert J. Kenngott, Manager of American Cyanamid Company's plant in Santa Rosa County. We employ almost 700 people in the production of acrylic fibers. This plant was built in 1958 and has been expanded considerably since then.

It is the stated policy of our company that "water and air are essential resources which must be managed and kept clean in accordance with reasonable and

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realistic standards. These standards must protect the health of the nation and, secondly, recognize the requirements of the component elements of a growing economy and society. The proper management of these resources will permit their use and reuse by agriculture, industry, and municipalities while still satisfying the recreational needs of a growing population."

It is Cyanamid's view that, "The evolving solution of these problems can best be attained by cooperation between industry and government with particular emphasis on local and regional participation."

As part of this policy, Cyanamid builds "effective water and air pollution controls into the basic design of new plants, and seeks to make improvements in its older facilities as advances in technology make it practicable to do so."

I would like to point out that this statement was not prepared for this meeting but was a statement given by our chairman of the board in 1966 to the shareholders in Cyanamid.

Prior to the erection of the plant, Cyanamid devoted 6 years to determining the characteristics of the process wastes, the most satisfactory method of treatment, and the probable effects of the treated effluent on the waters of Escambia Bay. Some of this work was reported in the publication "Sewage and Industrial Wastes," in papers entitled "The Assimilation Behavior of Certain Toxic Organic Compounds in Natural Water" in an issue dated September 1956, and another in an article "Planning a Waste Survey" in an issue dated January 1958. Copies of these are transmitted herewith. These reprints contain much information pertaining to Escambia Bay and have not been referenced in the present Federal report.

(The reprints will be found at pages 336-356.)

The chemical and biological nature of the process waters and wastes were exhaustively studied and analyzed during the pilot plant development of our process. In addition, dispersion studies, similar to those reported today, were made to provide a basis for the location of our effluent line. The final data overwhelmingly confirmed that Cyanamid's wastes would not be toxic to fish life and marine organisms, would not cause discoloration, and would not create odors. The original design provided for the recovery of substantial potential wastes to minimize the load on the bay, neutralization, equalization, and settling.

This design was approved and a permit granted by the Florida State Board of Health in 1958 and the treatment facility was installed at a cost of $1 million. After a survey in 1959, this agency stated that "the treated water from Cyanamid was not introducing measurable pollution into Escambia Bay."

In 1966, Cyanamid received a permit to expand its treatment facility at a cost of an additional half million dollars. Furthermore, we have spent over $100,000 in projects intended to reduce contaminant flow to our effluent system.

Our wastewater treatment system is monitored continuously. Samples are taken frequently from Escambia Bay. Monthly reports showing results of analyses are submitted to the Regional Engineer of the State agency.

With respect to Chapter 28-5.05 F.A.C., most recently amended January 17, 1969, Cyanamid has given the highest priority to meeting these requirements and is proceeding as expeditiously as possible toward full compliance on or before January 1, 1973, as stipulated.

Cyanamid's wastewaters contain many and varied constituents to be considered in the development of an effective treatment system where the problem of treating our specific wastewaters is unique, and the proposed statutory treatment goals are severe. Understandably, extensive studies are needed for meaningful evaluation of the treatment process and the development of a realistic solution.

Cyanamid has retained the highly regarded consulting engineering firm of Black, Crow and Eidsness, Inc., of Gainesville, Florida, and together with members of Cyanamid's Corporate Environmental Engineering and Industrial Medical Departments, a proposed program has been developed and submitted to the Florida Department of Air and Water Pollution Control.

Cyanamid's program embodies four phases with specific timetables: 1) wastewater characterization; 2) evaluation of methods for reduction, treatment and disposal; 3) pilot plant studies; and these will be followed by 4) design, engineering, construction and startup.

The first phase, wastewater characterization, is well under way, I am happy to report. This investigatory work provides the basic data for final treatment requirements. We have a huge amount of information to pull together. We may find that some promising treatments may not work out in laboratory tests.

Cyanamid will continue to work cooperatively with the regulatory agencies in meeting our obligations as a good corporate citizen working diligently to make reasonable and lasting progress. In return, we expect fair and equitable treatment, recognition for our efforts and progress, and reasonable patience during solution of problems which require unusual effort, time, and cost.

Now, I would like to make specific comments about the Federal Water Pollution Control Administration report released today.

The report offers considerable technical data that deserves most careful study. Many of the Federal findings confirm the correctness of our earlier work. However, we wish to offer several comments for your consideration and request the right to make further comments after additional study.

1) The report contains several statements regarding acrylonitrile. Cyanamid has made numerous analyses of our effluent; our results indicate acrylonitrile at a concentration of about 30 mg/1 -- far less than cited in this report, based on one analysis apparently. Since acrylonitrile is not detectable in the bay adjacent to our disperser nozzles, we are confident this has no harmful effect on fish life. This is supported by our observations that no dead fish were present within 1-2 miles of our outfall line at the time fish kills were reported in the northeast section of Escambia Bay.

Cyanamid anticipated this potential problem 15 years ago before the plant was built as evidenced by the

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work of Cherry, Gabaccia, and Senn, entitled "The Assimilation Behavior of Certain Toxic Organic Compounds in Natural Water," which was referred to earlier. This paper is an accepted authority on acrylonitrile toxicity and is cited in the Water Quality Criteria, California State Water Quality Control Board, which is referenced in this Federal report.

Because of our concern over the last several months in the rise of the number of fish kills in these waters, Cyanamid has intensified its fish bioassays. Our findings prove that native fish survive far longer than the standard 96-hour test period in an environment containing 75 percent of our effluent and 25 percent bay water.

In summary, we feel that the claim is unsubstantiated and the conclusion that Cyanamid wastes could be directly responsible for the reported fish kills is unjustified.

In view of the differences in analytical results, we will be pleased to cooperate with the appropriate parties to resolve this question.

2) The section on Toxic Materials also mentions the possibility that sodium thiocyanate, in the presence of free chlorine, may decompose to produce toxic compounds.

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Free chlorine has not been detected analytically in our effluent. Furthermore, our fish bioassay tests show that bay fish continue to live in high concentrations of our effluent. Nevertheless, if further investigation is desirable, we will be glad to cooperate.

3) The report states that Cyanamid discharges its effluent to the bay by means of a 1200-foot submerged outfall. The fact is that our pipeline extends 5000 feet into the bay. This submerged outfall was installed in 1957 and contains eight separate diffusers over the last 1200 feet. The design and operation of this discharge line was based on a comprehensive survey of the bay to determine its circulatory pattern and assimilative capacity, and take advantage of the currents at ebbtide and floodtide.

If the conclusions in this report submitted today, relative to Cyanamid, are based on the erroneous assumption that our outfall line extended only 1200 feet into the bay rather than its actual length of 5000 feet (almost a mile), we believe the conclusions should be reevaluated. These include references to nitrogen, dissolved oxygen, and organic sludges near our outfall in the northeast section of Escambia Bay and in Mulat- Mulatto Bayou.

4) I would like to change this just a little bit.

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It should be remembered that the first indication of the importance of nitrogen and phosphates to Escambia Bay was made June 18, 1969, when Mr. Paul Traina reported at the formative meeting of the West Florida Resources Council. Thus, in 7 months, these nutrients have gone from a matter of relatively little concern in that area to one of great importance.

I am sure that the conferees realize that the recommendations in this report for nutrient removal require an advanced degree of treatment. Cyanamid has addressed itself to the table presented on page 6 of this report, which allocates specific quantities of carbon, nitrogen, and phosphate which can be discharged to Escambia Bay. I am sure the Federal investigators will acknowledge that their studies were conducted rapidly and in a short period of time. We recommend that a more adequate baseline of discharges be established on a more comprehensive and statistical basis.

We will work with the State and local agencies in whatever manner is necessary to assure maintenance of water quality in Escambia Bay including a regional collection and treatment system.

In conclusion, I want to reaffirm Cyanamid's policy that air and water are essential resources to be managed and kept clean with reasonable and realistic standards by cooperation between industry and government.

Thank you.

* U. S. GOVERNMENT PRINTING OFFICE : 1970 O - 385-200 (Vol. 1)